ulton's Steamboat

page 200

ARCHIVES

OF

USEFUL KNOWLEDGE.

A WORK DEVOTED TO

COMMERCE, MANUFACTURES,

RURAL AND DOMESTIC ECONOMY,

AGRICULTURE,

AND THE

USEFUL ARTS.

"*Agriculture*, the basis of our strength; *Commerce*, the patron of our labour, and *Manufactures*, the resource for our wants—May these interests ever be united in support of the wealth, industry, and independence of the republic."

BY JAMES MEASE, M. D.

Secretary to the Agricultural Society of Philadelphia, Member of the American Philosophical Society, and Honorary Member of the Bath and West of England Society.

VOL. III.

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ARCHIVES

OF

USEFUL KNOWLEDGE.

Vol. III. JULY, 1812. No. 1.

PAPERS ON COMMERCE.

New Method proposed for measuring a Ship's Rate of Sailing. By James Burney, *Esq.**

A LINE towing astern of a vessel, which is passing through the water, will pull against her head-way. As the ship's way increases, the pull of the line will increase ; and *vice versa.* If this, with a proper scope of line, (about 25 fathoms may probably be sufficient), shall be found to be a regulated quantity of pull corresponding in the same manner at all times to the rate of sailing, it will answer the purpose of a log. Many experiments have been made upon the same principle ; but the most plain and easy one, of towing a measured length of line, has escaped trial ; though less liable to give erroneous or variable results than any which can be made near a ship. By it, the rate of sailing may be obtained either constantly or occasionally, and can be taken with ease by one person : in which respect it would have great advantage over the common log, the use of which requires three persons.

By a trial made in a boat with about 20 fathoms of line, rather larger than log line, towing astern and fastened to a spring

* From Nicholson's Philosophical Journal, Vol. 24, p. 57. London, 1809.

steelyard, the strength of the pull was found to vary with the rate of sailing, which, however, was not ascertained by measurement; but by estimation, the boat's rate of sailing during the trial varied between $2\frac{1}{2}$ knots and 5 knots per hour, and the pull of the line upon the steelyards was observed to vary from 2 lbs. to $5\frac{1}{2}$ lbs.; increasing and decreasing with the velocity. So great a variation in the strength of the pull gives all the advantage which can be desired for forming a scale, and will allow of the experiment being made with a smaller line.

If the proposed length of line is passed through a pulley so as to go clear out at the stern port or cabin window, and the inner end is fastened to a loose chain, of weight adapted to the purpose on the deck under the pulley; or to a number of small weights made consecutive by short intervals of line, the chain or weights will be drawn up more or less according to the ship's velocity. By a few comparisons of the quantity of weight raised from the deck with the rate of sailing, a scale may be marked.

In an improved state of the experiment, instead of using weights or a pulley, the inner end of the line (coming direct from the water) can be fastened to a spring, and communicate with an index that shall express the rate of sailing.

This machine (if so plain a contrivance deserve that name) may be put on constant duty, or dropped occasionally to ascertain the rate.

Objections which occur, are,

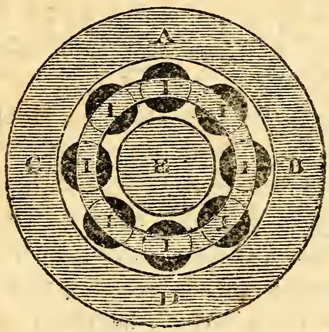
1st. The line being liable to contraction or expansion as the temperature of the water varies. But it is scarcely to be supposed, that the greatest contraction or expansion of line from its mean state (after it has been properly stretched and seasoned) will occasion an alteration of a hundredth part in the force of the pull.

2d. That in a fresh wind the part of the line between the ship and the surface of the water, will be liable to some additional pull from being exposed to the wind. To this inconvenience, the log line in the common way of heaving the log is likewise exposed when the wind is much aft. In either case, when the ship is

not right before the wind, the remedy is the same: which is, to throw the log or the line over from before the lee gangway, and to give a few fathoms more of stray line; for which, however, in the new method proposed, it would be necessary to apply a correction, the quantity of which may be accurately ascertained.

3d. The motion of a ship in pitching. But this is not to be regarded as an objection; for the rate of sailing is to be estimated only, by what the experiment shows when the ship is going steadily; in the same manner as in taking bearings, if the compass swings, we wait till it is quiet. Whenever the ship goes steadily for ten seconds together, or even five seconds, the pull of the line will be regulated to the average rate of sailing.

GARNETT'S PATENT SHIVES.



A B C D represents a ship's block or pully, of which E is the axis, having equal solid rollers, IIIIII, &c. nearly touching each other; and situated between the axis, and the inside cavity of the block or pully. The rollers are furnished with axles inserted into a brazen circular ring at each end, and are kept separate and parallel, by means of wires fastened to the rings between the rollers, and rivetted to them. The ends of the axis E, are fixed in a block after the usual manner. "By this method indeed, some friction unavoidably takes place betwixt the axles of the rollers and their sockets, in the brass rings, but as the quantity

of friction depends principally on the force by which the rubbing surfaces are pressed upon each other, and as in this case there is but the slight pressure occasioned by those accidental circumstances which would bring the rollers together, the friction must be too trifling to be noticed."*

"The holes too are made rather large, the use of the axles to the rollers being only to prevent their running one against the other; nor does the addition of weights upon the pullies, increase that friction, for the addition of weights upon the pulley will press the rollers harder upon the axis E, but not upon their own axis, as may be easily understood by inspecting the figure."†

This important application of a philosophical principle by Mr. Garnett,‡ formerly of Bristol, England, but now of New Brunswick, (New-Jersey,) has been of the greatest service to navigation, as in a vessel rigged with those blocks, three men are able to do the work of five, with a set of common pulley blocks.

The following facts, communicated to the Editor by Captain Bliss of Philadelphia, will particularly show the power acquired by their use.

In the Delaware, near Chester, in very holding ground, he never was able to raise his best bower anchor, without a purchasing handspike; but the next voyage, having supplied himself with a patent roller for the hawse-hole, he anchored in the same place, as formerly, and in heaving up his anchor without it, he hooked up another anchor weighing 1300 cwt. He added, that with a common ship's crew, he could at any time, when getting under way, have his three topsails set at once after having the patent blocks in his rigging.

These rollers admit of an extensive application to all sorts of circular motion round an axis; and they have been accordingly so prepared by the ingenious patentee. Besides their use in blocks, pulleys, and hawse-holes of ships, they have been applied

* Encyclop. Britan., art. Mechanics.

† Cavallo's Nat. Philos., Vol. 1.

‡ Not *Gamett,* as printed in the Encylop. Britan., art. Mechanics, and in Rees's Cyclop., art. Friction.

to the boxes of carriages. The Editor had them fixed to the axle of a wheel attached to a straw-cutter, and carrying three knives, the power of which is very great, and works so easily, that a boy of 12 years old can turn it, and in a few minutes cut straw enough for mixing with the food of several working horses.

It is to be regretted that the inventor of this useful contrivance, has not taken measures to establish the manufactory in the United States.*

* The following advertisement appeared some months since in the Boston papers:

IMPROVED PATENT IRON SHIVES.

Recommended by the principal Merchants and owners in the town of Plymouth, Massachusetts.

We, the subscribers, having had opportunity, from the repeated trial on board our shipping; do give our decided opinion, that they are both useful, and durable; and do hereby publicly recommend them to the owners of shipping.

BARNABAS HEDGE, JUNR.
WILLIAM DAVIS,
ROBERT ROBERTS,
JOHN CLARK,
ATWOOD DREW,
WILLIAM HOMES,
TRUEMAN BARTLETT,
JOSEPH BARTLETT,
NATHANIEL CARVER.

N. B. These Shives being cast upon a polished Pin, (which is driven out when the Shive cools) the hole acquires a degree of hardness, equal to hardened steel; and being perfectly smooth and straight, the Shive runs light and easy on the pin. They are warranted to last for seven years, and it is believed from the examination of those which have been in use, that they will last much longer, (with proper management) by occasionally rubbing the hole with tallow in the inside. They are not found to wear the shell of the Block, and are more firm and substantial, than any cogg'd Shives whatever; and as the edges of the Shives never crumble in wear, like Lignum Vitæ, they preserve the rigging. The above with turned iron pins, are for sale by Bemis & Eddy, agents for the patentee, No. 12, Long-wharf.

PAPERS ON MANUFACTURES.

ON ROLLING COPPER INTO PLATES.

The following method of rolling Copper into plates, as practised at the extensive works at Taybach, in Wales, is taken from Donavan's Tour through South Wales and Monmouthshire.*

BEFORE the copper is converted into plates or bars, the pig of metal is made red hot, when it is closely beaten together under the hammer, and cut into pieces of the most convenient length for the purpose wanted, by shears moved by a wheel. Again, those pieces are conveyed to the furnace when they become red-hot as at first. One of the pieces is carried at a time to the flatting mill, a machine not much unlike the rolling press of a copper plate printer. The two cylinders are of steel, case-hardened and secured within a frame of iron. A man stands on each side, and while the two cylinders revolve, each in a contrary direction, one of them lifts up the piece of red hot copper with a pair of tongs, and thrusts it between the cylinders, the other man on the opposite side securing it with his tongs as it passes through. This he lifts back again over the upper roller to the first man, who by the assistance of a strong screw, diminishes the distance between the two cylinders, in order to widen and compress the plate still more; when it is conveyed a second time between them. This screw is turned for the same reason every time before the plate passes between the cylinders, and thus by the most simple process imaginable, the plate is gradually reduced as thin and broad as the workmen may desire.

By means of a similar machine, the copper is wrought into bars instead of plates, of any form or thickness, with equal facility. For the latter purpose, the smooth surface of both the cylinders are alike indented with eight, ten, or more distinct grooves, all which differ from each other in width and depth. The series commences with the largest groove, encircling one end of the cylinder; the next in point of size succeeds, and thus they di-

* Vol. 2, p. 59. London, 1805.

minish gradually to the other extremity of the series, which terminates with the smallest groove. The piece of copper being heated as before to a fiery redness, the workmen force it between the first or largest groove of the adjusted cylinders, where it receives either the round or angulated form of the groove from the compression of both the cylinders, as readily as wax in a common mould. Should it be necessary, the bar is conveyed in like manner progressively through the second, third, or fourth groove, or through the whole series, till it is reduced to the thickness wanted, the length being increased in proportion as the bulk diminishes.

The copper, after receiving its proper form in the flatting mills, and cooling, is of a dusky black, or iron colour, and in order to communicate to it that lively hue which is commonly understood to be the true complexion of this metal, the plate or bar is heated again for the last time in a furnace, and when red hot is plunged into a recess filled with a saline liquor,* where it assumes that colour in a few moments, and being withdrawn, the copper is put aside as being finished for exportation.

METHOD OF TINNING IRON PLATES.†

This manufactory is carried on extensively in Caermathen, in South Wales.

THE iron ore employed in this manufactory is the common argillaceous kind, of South Wales, intermixed with a considerable portion of the Ulverston ore of Lancashire, a rich *hematite*, the latter, which it is deemed necessary to smelt with the other sort, in order to produce a metal of such pliability as the iron plates designed for tinning require.

These ores are reduced to a state of fusion together, by the means of charcoal, a fuel far superior for this purpose to the

* In Aikin's Chemical Dictionary, it is stated, that this fluid is urine. The redness which the copper thus acquires, is considered by the merchant as one mark of the purity of the metal. *Editor.*

† From Donavan's Tour through South Wales, Vol. 2, p. 193.

coke of sea-coal, every impurity in the metal being destroyed, or expelled, by its assistance. The machinery of the smelting work is on the old construction, a large double pair of bellows, worked by a common water wheel, being found to possess all the powers requisite to keep the blast upon the charcoal while the ores are smelting.

After the iron passes through the finery, and is cast in moulds into the form of pigs, it is beaten into long flat bars by the repeated strokes of a ponderous hammer, kept in motion upon the anvil by water; and after this, the bars are cut in pieces of about ten inches in length, by the aid of shears, kept also in motion by the force of the stream. The desevered pieces are next conveyed to a furnace, and when thoroughly heated, are passed between the two massive cylinders of a flatting mill, such as we had before observed at Taybach for reducing the bars of copper into plates. The piece of iron, at the first pressure, extends in length, and width: the adjusting screws are turned still closer, and at the second pressure, the superficial dimensions of the iron are encreased considerably again. When the plate by this process becomes twice the size that plates of tin are in common, it is replaced in the furnace till it assumes a fiery red appearance: the forgemen then withdraw it, and, by a brisk turn with their tongs, folds it directly across the middle, pass it between the cylinders and repeats the operation till the folded plate appears of the same length and breadth as it appeared before it was doubled. Being again heated, bent, and submitted to a comparatively slight compression of the cylinders for a third time, to press the whole together compactly, the edges are clipped with shears, and the plates sixteen in number, are torn asunder, these adhering slightly by their surfaces to each other. A larger number of plates may be made of the same quantity of iron, by folding and passing them between the cylinders again, the thickness of each individually diminishing, of course, in proportion to the greater number of plates into which they are divided.

The trimmings or cuttings from the plates, to reduce them to the size required, are laid aside for the founderies, where they are

converted into bolts for ship building. The plates, when separated, pass through another kind of rolling press, the whole machinery of which is adjusted with such accurate precision, that the slightest wrinkle, or contortion in the plate, will impede their passage between the cylinders, and in that case they are condemned as useless. On the contrary, those which do pass through, appear with a surface perfectly smooth and polished, and are then conveyed to another part of the works where they receive the tinning.—Here the stranger, should the strength of his nerves enable him to endure with the most nauseous stench imaginable, may trace the further progress of this kind of manufacture. Preparatory to tinning, the plates are steeped for a certain length of time in a weak corrosive liquor, or nitrous acid; after which they are taken out, and rubbed, or well scoured and cleansed from the slightest impurity of rust with bran, and are then carried to the crucibles for dipping into the melted tin.—This useful metal is not the product of this country, but is imported hither in blocks of a covenient size, ready purified, and fit for use from the stannaries of Cornwall. The crucibles are of a rectangular form, and pretty deep, to admit the block of tin which is to be melted, and kept in a fluid state by means of a moderately brisk charcoal fire under the crucible. To prevent the calcination of the tin, as well as to prepare the iron plate to receive the tinning kindly, the liquid tin is kept floating in an oil, either that of linseed, or one prepared on purpose from boiling suet. The plate is taken by one corner with a pair of forceps, immersed vertically in the tin, and upon being withdrawn, its dingy surface on both sides is found changed in a moment to a beautiful silvery white. A second, and third dip into the tin, is required for what is called *single tin:* double tin demands a repetition of the process or six times dipping, and in certain cases much more. This is the last process, the plates being afterwards only cleansed with bran, sorted, and packed up in boxes for exportation.

Those works employ a number of persons, girls and women, as well as men: the latter are engaged in the various laborious departments of smelting, milling the plates, and tinning; the fe-

males in preparing them to receive the tin, or in cleansing them afterwards with bran.

Some further particulars may be added from other authorities.*

In many manufactories, the iron plates, before tinning, are cleansed by being immersed in large barrels full of a mixture of rye flour and water, sometimes with verjuice, which by fermentation has become very acid. In Bohemia, the plates remain three times twenty-four hours, in tubs filled with this ascescent mixture, in three different states, after which they are washed, scoured with sand and water, and kept under water till just before they are used, to avoid rusting again.

Attention is to be paid to the heat of the melted tin: if too hot, the plate comes out yellow. The plates are immersed quite wet into the melted tin, passing in their way through the melted suet which covers it. Just before dipping, some water is thrown on the melted suet, which causes a violent ebullition, and makes the surface of the metal quite clear and bright. The plates when tinned, are set up to drain, by which a number of drops of tin collect in small knobs at the lower part. These are taken off by a second immersion into a separate cauldron of tin, but only to the depth of a few inches; by which the drops of tin melt down, and the whole tinning is made more uniform in thickness. They are then cleansed with a rag and saw-dust or bran. About 19½ pounds of tin are required for 300 plates, measuring one foot by nine inches.†

In the manufacture of tin plates on the continent of Europe, a quantity of copper is always added to the tin, but in very small proportion. The exact quantity is regulated by slight circumstances, which only experience can teach. It appears to be in general from $\frac{1}{80}$ or $\frac{1}{120}$ of the tin. The copper prevents the tin from adhering in too great a quantity to the iron, and causes the superfluous part to drain off more freely. Too much copper gives a dull yellow tint.

* Aikin's Chemical Dictionary.

† Encyclop. Arts and Metieres, art. Ferblantier.

ESSAY ON THE NATURE OF SHEEPS' DUNG, AND ON ITS USE IN DYEING COTTON OF A TURKEY RED COLOUR.

By M. J. B. Vitalis, *Professor of Chemistry at Rouen.*

From the Journal de Physique.

THE process which is used at present in the dye-houses, for dyeing cotton of a Turkey red colour, was originally practised in the Levant, and is composed of a series of operations; every one of which requires to be examined by the light afforded by chemistry, if it be wished to be certain of success in this kind of dyeing.

The author being charged by the government to teach the principles of chemistry in respect to its application to the useful arts, it was necessary for him to pay particular attention to that branch of industry which forms the basis of the manufactures and trade of the first manufacturing town in France.

The manufactures at Rouen employ colours both of the bettermost and common sort. By means of certain preliminary preparations there has been given to the latter, a degree of brightness and even solidity hitherto unknown, which was probably the reason that they were admitted to be shown at the exhibition of the year 1806.

The middling and most numerous class of citizens must have goods of a price proportional to their means. The common colours also employ a great number of workmen, and yield a profit which other towns would be ready to seize, if the manufacturers of Rouen should in time despise it.

But it is principally from the bettermost colours, that is to say, those which are dyed in the manner of Turkey red, that that town derives its glory and riches. These colours have opened to industrious manufacturers an immense field of inexhaustible riches. The manufacturer may now enrich his designs with that variety, that happy mixture, that elegant association and harmony of colours which is so agreeable to the sight, and will please the taste of the most delicate connoisseur, and of one the most delicate to be pleased. These are not fugacious and ephe-

meral colours that impose for a moment upon the eye by a false and deceitful brilliancy, but which may be said to vanish as soon as they are produced. Turkey red, and the numerous train of colours that depend upon it, such as cherry red, rose red, voilet, lilac, pullicats of every shade, clove browns, amaranths, &c. are but little acted upon by the most powerful agents, and scarcely yield to the long-continued action of air, light, and soap.

It is to the employment of these colours, that the manufactories of Rouen owe the high degree of reputation which raises them above all ther rivals.

The process of dyeing Turkey red is therefore an object of the highest importance and consideration to them.

A search has therefore been made, as far as was possible, to smooth the difficulties and dissipate the uncertainties that exist in the operations, which cotton destined to receive the Turkey red colour is made to undergo, by applying to each of them the torch of chemistry, and by examining them in the relations they may have with the principles of that science.

The results of the researches on the nature and use of sheeps' dung in the dyeing of Turkey red, are now presented to the Institute. The end of this essay is to settle the action and influence of the dung-vats, which are the first baths that are given to cotton in dyeing it Turkey red.

According to Le Pileur d'Alpigny, in his art of dyeing cotton, neither the dung nor intestinal liquor of sheep are of any utility in fixing the colour; but it is known, says the author, that this kind of excrementitious substances contains a great quantity of volatile alkali in a disengaged state, which has the property of brightening *(roser)* the red.

Felix adopts the same opinion in an essay on the dyeing of the red spun cotton from Greece, and on the trade in it, inserted in the Annales de Chimie, tom. 31, p. 195.

The ideas which the dyers have formed on the nature of the dung baths, are so far removed from any appearance of fact, that it is perfectly needless to mention them. How indeed, for example, is it possible to suppose that dung is only useful because

of the remains of vegetable matters that it still contains, and which, by the small size of its molecules serve to divide the oil that is always mixed along with the dung to form these baths?

On recollecting what the most celebrated authors have written on the nature of animal excrements in general, it was impossible not to conceive some doubts at least respecting the opinion of Le Pileur d'Apligny.

In order to form a precise opinion respecting the use of sheeps' dung in the kind of dyeing here mentioned, it is necessary to pay attention to the mucus liquor which lines the internal parts of the hollow viscera, and of the canals that are open to the air, and communicate from the exterior of the body to the internal parts, as the œsophagus, trachea, intestines, &c.

This mucus, says M. Fourcroy, destined to lubricate the parts just mentioned, to keep up their softness, and the heat of their surface, and to hinder them from becoming dry and stiff, contains a kind of gelatinous albumen, but little inclined to become dry; being deliquescent, scarcely growing thick in the air, and keeping up the suppleness and mobility of the sides of the canals in which it is deposited.

Haller, in his immortal work upon physiology, represents the intestinal liquor as a mixture of bile, pancreatic juice, the residuum of the food, the mucus of the intestinal cryptæ, and a humour separated from the extremities of the arteries. This last liquor is, according to the celebrated Swiss physiologist, the most abundant, and may be looked upon as the real intestinal liquor.

Besides the uses already mentioned, it also serves, according to M. Fourcroy, to destroy the acrimony of the food as well as to dilute and to connect the excrements.

On applying these principles to the intestinal liquor of sheep, it cannot be doubted but that this liquor exists abundantly in the residuum of the digestion of this animal, and that it is to the presence of this liquor in them, that the advantages obtained from dung-baths in dyeing ought to be attributed.

Volatile alkali, therefore, is not present in a disengaged state in sheeps' dung, as Le Pileur d'Apligny pretended.

Macquer observed, a long time ago, that fresh excrements do not yield any ammonia by the first impression of fire, as is done by animal substances which have undergone putrefactive fermentation; from whence it follows that ammonia is not present in recent dung, and that this alkali can only be met with in it when the balance of the original attractions is broken by putrefaction, which produces new attractions to which the formation of the alkaline product is owing.

Experiments have dissipated every doubt on this subject, for from them, it appears that 61.19 grammes* of fresh sheeps' dung, yielded on distillation.

	grammes
Acid and alkaline liquor, . .	48.8
Gaseous fluids, ...	0.58
Concrete and liquid oil, . .	3.91
Charcoal and phosphate of lime, .	7.3
	61.09
Lost, ...	.1
	61.19

It therefore not only appears that ammonia does not exist ready formed in sheeps' dung, but also that it cannot exist in it in a great quantity, as stated by Le Pileur d'Apligny.

So that the properties which are ascribed to the ammonia contained, as it is said, in large quantities in sheeps' dung are as imaginary as the being to which they are ascribed. It therefore becomes necessary to search in some other principle for the cause of the effects produced by baths of sheeps' dung in dyeing Turkey red.

But this principle can be no other than the albumino-gelatinous matter abundantly contained in the excrements of sheep. It is only necessary to pay attention to the manner in which it is used in the dye-houses, in order to be convinced of this.

The dung is first macerated, for a longer or shorter time, in a cold solution of soda, marking about 4° by the hydrometer. The

* A gramme is equal to about 15 1-2 English grains. *Editor.*

intention of this maceration is evidently to bring about the solution of the albumen and gelatine by means of the alkali. Afterwards a certain quantity of this solution, strained through a sieve and diluted with water of soda at 2° hydr. is mixed with fat or mucilaginous olive oil; by which means there is formed a sort of liquid animal soap, with which the cotton is carefully impregnated.

In this preparation, the cotton by combining with the albumen and gelatine, approaches in some degree to the nature of animal substances, which are well known to have a much stronger attraction for colouring matters than vegetable substances have. The combination appears to be favoured by the oily principle which is combined at the same time with the cotton.

It may thus be seen why authors who have written on Turkey red recommend not only the use of dung, but also of the intestinal liquor of sheep, which would be still more advantageous, if it was possible to procure it in sufficient quantity for the use of dyers.

Experience is evidently in favour of the theory just mentioned.

Fresh sheeps' dung was macerated for 4 or 5 days in a ley of soda at 4° hydr.: it was then filtered, and a reddish brown liquid was obtained. The alkali was then got rid of by adding very dilute sulphuric acid, and an abundant light precipitate appeared, and was deposited at the bottom of the vessel, after having occupied for some time the whole bulk of the liquid.

In order to leave no doubt on the nature of this precipitate, it was collected upon a filter, and after being well washed with cold water, it was boiled in a phial with pure water for about an hour, and the reddish yellow liquor was then decanted, into which a solution of tannin being poured, a precipitate was formed that plainly shewed the presence of gelatine.

The albumen, coagulated by the action of caloric, remained at the bottom of the phial in the form of small, soft, and spongy lumps; and if a judgment may be formed from the quantity of undissolved matter in the water, although it was renewed three

or four times, albumen is much more abundant than gelatine in sheeps' dung. It is not far from the truth to say, that the proportion of the albumen is superior to that of the gelatine in the ratio of at least 3 to 1. But particular circumstances have hitherto prevented the exact determination of this point.

In order to remove every doubt on this subject, it was attempted to supply the place of dung-baths by an alkaline solution of white of egg, or albumen, and perfect success was obtained, both with bettermost and common colours. They all acquired much more solidity than when the use of natural or artificial dung-baths was neglected.

This last observation, founded upon reason and experience, completely overturns what Le Pileur d'Apligny advanced, when he said that the dung or the intestinal liquor of sheep are of no use in respect to the fixing of the colour.

The essential principles brought forward in this essay may be reduced to the following.

1°. Sheeps' dung used in dyeing Turkey red does not contain ammonia.

2°. Ammonia has not the property of enlivening (roser) Turkey red.

3°. Sheeps' dung acts only by the albumino-gelatinous matter that it contains ; which serves to reduce the cotton to the nature of animal substances, and of course to dispose it to unite more solidly with colouring matters than before.

4°. The dung and intestinal liquor of sheep are very useful for fixing colours in general, and particularly Turkey red.

A TREATISE ON THE ART OF DYEING WOOLLEN CLOTH SCARLET, WITH LAC LAKE.

By William Martin. *London.* 1812.

The following important treatise, which recently issued from the press, was received by the Editor from an attentive correspondent in London.

HITHERTO *Cochineal* has been the only substance found to produce *Scarlet* in perfection. The colour obtained from *Madder* and the *Woods* scarcely deserves the name, as it fades or changes, in a very short time, to a dusky brick-red; and though that from the insect *Kermes* is more permanent, it will not bear any comparison with the colour produced by cochineal.

But the price of cochineal is so high, that its use is attended with great expense; and vast sums have been expended by the nation in procuring it from foreign countries; the price at this time, in the London market, being from 30*s*. to 35*s*. per lb.

The process I have discovered and brought to great perfection, produces, with lac lake alone, a scarlet colour on wool, equal to that from the finest cochineal, with the important advantage of being more permanent.

It is scarcely necessary for me to remark, that it will be utterly impossible for those who use cochineal, to meet those who employ lac lake in the market.

The only thing required in particular for lac lake, if the experiment is made on a small scale, will be a glazed earthen vessel, in which to make the solution of the colour.

OF LAC LAKE.

Lac lake is the colouring matter of an insect, called by the natives in India, Lacca, or Lácshà, precipitated from its solution in an alkaline lixivium, by a solution of alum.

The sticklac, from which the colouring matter is extracted, is procured chiefly in the uncultivated mountainous parts of Hindostan that border on the Ganges, and it is found in the same situations on the other side of that celebrated river; it is also

said, that a kind, more abounding in colour, is brought from the kingdom of Siam.

The insect that produces the substance from which the colour is obtained, is of the order *Hemiptera* in zoology, and genus *Coccus*, being a species of the same genus as the cochineal: the species of the lac insect is denominated *Coccus Lacca;* the cochineal species *Coccus Cacti.* The lac insect is produced on the branches of several different kinds of trees and shrubs, among which may be enumerated the Indian fig or Banian tree, the Arabian Buckthorn, and a species of Mimosa, called by the Hindoos, Conda Corinda. Sometime after these insects are produced, in the early part of January, they fix themselves toward the extremities of the succulent young branches in vast numbers, remaining without any movement or appearance of life, whilst a sub-pellucid liquor exudes from their bodies, appearing to glue them to the branch: this liquor accumulates around them, and hardens by degrees, until at length a complete cell is formed for each insect; and the branch, from their numbers, is nearly covered with this hardened substance, which is rather of the nature of wax than gum or resin: so that the name given to it of Gum lac is not the most proper. About the beginning or middle of March the cells are completed, and the insect appears like a small red bag, of an oval form, emarginated at one end, and filled with a beautiful red liquid. In this liquid the eggs are deposited and hatched, the grubs remaining until the red fluid of the mother is exhausted, which happens generally about the month of November. The young insects then pierce a hole in the back of their mother (now reduced to a mere shell, like the exuviæ of a caterpillar), and escape; leaving behind them a membraneous substance like cobweb, with which they had been enveloped.

At the proper season, the natives break off these branches, and carry them to the market for sale; no doubt before the young insects escape, which are probably killed by immersion in hot water; and we receive these branches or twigs here, usually packed in bags, under the name of sticklac: we also receive a

kind that is nearly without colour, but applicable to the same purposes as shellac.

It is not more than four or five years since lac lake was first manufactured at Calcutta, from which place we have received all that has come to this market.

When it is intended to manufacture lac lake, the lac is separated from the branches, procured as fresh from the tree as possible; it is then garbled and powdered: this powder is put into a glazed earthen vessel, and a boiling alkaline lixivium poured on it. The wax melted by the heat remains at the bottom, while the lixivium dissolves and takes up the colour. The coloured solution is then decanted into another similar vessel, and a solution of alum, sufficient to saturate the alkali, poured into it; the colouring matter immediately precipitates in conjunction with the alumine, and the sulphuric acid, in union with the alkali, remains in solution. After settling some time, the liquid is poured off, and the lake which has precipitated is formed into small squares, and dried. It is usual, I believe, to diffuse in the solution of alum a small quantity of the bark of an unknown shrub, called by the natives Autour Bark, after reducing it to a very fine powder; and this is supposed to promote the more complete precipitation of the colouring matter. The wax remaining, deprived almost entirely of its colour, is manufactured into that very useful article shel lac, by melting, straining, and forming it into very thin plates; becoming by this means, semi-transparent, and of an orange yellow hue.

Lac lake manufactured in the way described, when the squares are perfectly dry, assumes a dull brick colour on the outside; and after some time, a gray powder effloresces on the surface. When a square is broken, it appears of a dark chocolate colour in the inside, and the fracture is compact, smooth, and shining; scraped with a knife, the powder is of a red colour, inclining to crimson. These are the characteristic marks of good lac lake.

Compared with an equal weight of the best cochineal, the colouring matter of lac lake, PROPERLY DISSOLVED, is nearly equal in quantity to the colouring matter of the former.

Our East India Company have lately received a few chests of this colour, prepared in a different manner from that described. The squares are nearly black throughout, the exterior inclining to purple. This kind is not soluble in the same menstruum as the other, but may be used by grinding it in the mortar with a little hot water, and twice its weight of the composition; afterwards diluting it with a sufficient quantity of warm water to form the bath; the process, in every other particular, being the same as will hereafter be described for the other. Upon trying, separately, equal quantities of each kind, I did not find any perceptible difference in the quantity of colouring matter. The colour given to the patterns tried, were both very beautiful; but that given by the Company's was not so clear nor so intense as the other. This I impute to some quality in the solvent employed for the latter, and to the advantage it has over the Company's, from the depuration it undergoes after it is dissolved. This I think a very important advantage; for it is obvious, by mere inspection, on breaking a square, that the Company's contains some extraneous matter, which I take to be the web of the insect, dissolved and precipitated with the colour, and which undoubtedly sullies it on the cloth.

OF REFINED BORAX, THE PROPER SOLVENT OF LAC LAKE.

The crystals of refined Borax, in appearance somewhat resembles the crystals of Glauber's Salt. Borax is composed, according to Bergman, of

39 parts Boracic acid
17 — Soda
44 — Water.

From its component parts it is called, by scientific chymists, Borate of Soda.

Refined borax is white, transparent, and sometimes covered with a mealy powder; when broken, the fracture has a greasy appearance.

It dissolves in twelve times its weight of cold, and in six times

its weight of boiling water: its taste is not unpleasant, slightly acid and cool, leaving a sensation of sweetness on the tongue.

In its crude state it is called Tincal, Brute Borax, or Crysocolla. What we receive here comes chiefly from Bengal, where it is brought in its crude state, as dug out of the earth, from Persia and China. It is also found in abundance in the mines of Peru near Potosi, in South America.

The price of English refined borax, is generally from 2*s.* to 2*s.* 6*d.* per pound: in larger quantities, it may be purchased at a cheaper rate.

Although I consider refined borax as by far the best and most proper solvent of lac lake, yet I have found, that very pure crystals of soda will also dissolve a considerable portion of it, at a boiling heat; but this solution has not afforded me near so good a colour as the other. Perhaps methods may hereafter be found to employ it with advantage.

I have tried Potash in various ways, and degrees of strength: it takes up a little colour, but gives off a miserable one to the cloth.

OF SOLUTION OF TIN.

Solution of Tin, called also "Composition," and by our dyers "Spirits," is made by dissolving the purest grain tin in *Aqua Regia*, or nitro muriatic acid.

Aqua Regia may be made in various ways; but I shall only give that which is the most approved, and which experience has shewn to be the best adapted for the scarlet composition.

Into a large flint glass bottle, having a glass stopper, put one pound of the purest and strongest nitric acid, or aquafortis, and add to it an equal weight of water, filtered through blotting paper. Thus diluted, it should weigh about one-fourth more than an equal measure of water. To this must be added, one-eighth of its weight (four ounces) of refined sal ammoniac, previously bruised in a cloth, or broke into small pieces; afterwards putting the stopper in the bottle lightly, and setting it aside until the sal ammoniac is completely dissolved, which it will be in a day

or two. This will now form an aqua regia the most proper for our purpose.

Four ounces of the finest grain tin, in small pieces, is next to be added by degrees, and the bottle again slightly stopped, and set aside until the tin is dissolved. It will require some days before the solution of the tin is completely effected; and it is advantageous that it should go on slowly, and withont efferves-cence: long experience having proved that a solution made without heat, and without the disengagement of much vapour, produces the best effects of the colour. The tin, by the action of the acid, will sometimes first assume the appearance of a salt, not unlike sugar of lead, before it entirely dissolves. It frequently happens that a small quantity of black sediment remains at the bottom of the bottle: from this the solution may be decanted, and, after washing out the bottle, poured back again.

The tin being dissolved, ten ounces (one-fourth the weight of the whole) of filtered water is to be added, and the solution laid by for use. It should now be transparent, and of a bright lemon yellow colour.

If the composition should be wanted in a shorter time than it will take to form by the foregoing method, the solution of the tin may be hastened by immersing part of the bottle in warm water: but care must be taken that the water is not too hot, and also to loosen the stopper, that some part of the vapour may escape; otherwise, the bottle will be liable to burst. It will be adviseable, while the solution of the tin is going on, to place the bottle where there is a current of air; and, as much as possible to avoid breathing any part of the noxious vapour that issues from it.

As fresh-made composition produces a finer colour than what has been long kept, it will be best to defer making it until a short time before it will be wanted. When it has been so long made, that a milky cloud begins to form, it will not produce so good a colour; but when it becomes a jelly (as some compositions made in the common way will do), it is utterly unfit for use. When this jelly first begins to form, it may be recovered by

adding to it, either a solution of common salt, or of sal ammoniac.

It will be necessary to be careful in choosing the tin as pure as possible : if the fine grain tin is not easily procured, the best bar tin may be used. This should be cut into lengths of an inch or two, melted in a brass ladle, and poured, while in fusion, into a large bason of water, to separate it into small pieces.

The method I have described of making the composition, is considered the best known, and is that which I have followed : but almost every dyer has his own receipt : and, no doubt, that which has produced him good effects with cochineal, will do the same with lac lake.

I shall conclude the subject with observing, that to be certain of the same results, the composition must be made uniformly in the same manner, and with the same proportion of ingredients.

OF WATER.

There is no colour in the art of dyeing, that requires so much attention to the water employed, as scarlet. It should be what is well known under the denomination of soft water, and it should be perfectly tasteless, clear of floating particles, and transparent. Water that has made a long course undisturbed, exposed to the sun and air, and afterwards left to settle, generally possesses these qualities in perfection. But it may happen, that water shall be exceedingly clear and transparent, yet hold many earthy and metallic particles in solution : when this is the case, it may be known by a peculiar taste, and by the circumstance of curlding soap attempted to be dissolved in it. What has just issued from wells, is mostly of this description ; it is called hard water, and cannot be used for dyeing scarlet.

The earthy and metallic principles most common in water, and those most injurious to the scarlet dye, are lime and iron : therefore, if it be possible, the use of water that has passed in its course over beds of calcareous earth and lime-stone, or through iron pipes, should be avoided ; for although the portion of these substances taken up by water is very minute, and considered be-

neficial to the human constitution when drank, yet they may in some degree tarnish the delicate colour of scarlet.

Before the water is let into the cistern or vats, the state of the river must be attended to : after heavy rains and stormy weather it will be muddy, coloured, and unfit for use ; it must therefore be left some days after such weather, to settle and deposit the earthy and other matters floating in it, and should not be let into the vessels until it recovers its clearness and transparency; and even after that, it should remain some days longer in the cistern undisturbed, to acquire the utmost degree of purity, before it is drawn off for the boiling, or to prepare the colour.

With these precautions the most brilliant colours may be expected.

OF THE BOILING, OR PREPARATIONS OF THE CLOTH WITH THE MORDANT.

Woollen cloth would neither receive nor retain the colouring particles of the scarlet dye without undergoing a previous preparation by boiling it in what is usually called the mordant. Dyers name this operation "the boiling."

The ingredients for the boiling, are cream of tartar, and solution of tin : of these, the proportions used, vary almost in every dye-house. Those which I shall give, I by no means give as the best ; but, I can state, that the cloth prepared according to them (on the smallest scales) has always taken as beautiful and as intense a colour as could be desired : I believe that the proportions most commonly employed are about one-eighth less, but seldom more : and I have understood that many dyers make the proportion of solution of tin less than the tartar.

Proportion of ingredients for the boiling on different scales.

Cloth.	Water.	Tartar.	Solution of tin.	To boil.
1 oz.	1 quart	1 drm.	1 drm.	$1\frac{1}{2}$ hours
8 oz.	2 gallons	1 oz.	1 oz.	ditto
1 lb.	4 gallons	2 oz.	2 oz.	ditto
20 lbs.	80 gallons	$2\frac{1}{2}$ lbs.	$2\frac{1}{2}$ lbs.	ditto

It is necessary to observe, that evaporation goes on much

more quickly in small vessels than in large ones; it will be better in performing the process on the smaller scales, to employ only *half the quantity* of cloth stated, otherwise it is probable there will not be enough of the liquid left towards the end of the boiling, and the experiment will not succeed.

For the purpose of making this experiment it will be necessary to provide a well glazed earthen pan, having a cover and a handle, taking care that the cover does not project beyond the sides, to intercept the smoke, when charcoal is employed in an open stand. If this pan could be set on a small furnace to prevent the injury that may arise from the smoke, it would answer much better; but if this cannot be done, a charcoal stand may be placed on the hearth of a fire place where there is a good draught of air up the chimney, and a sufficient quantity of good charcoal provided. Care must be taken that the stand be large enough, and contain sufficient firing to keep the liquid boiling, and it should be so made that fuel may be supplied without taking off the pan. The pan should hold about one gallon and a half of water; and having set it on the stand with *one gallon* of clear and soft water, (that has either been filtered, or stood ten or twelve hours to settle) the fire is to be lighted. When the water is warm, four drams of very pure cream of tartar is to be put into it, stirring it with a stick made of a piece of fir lath. When the tartar is dissolved, the same quantity (four drams) of solution of tin is to be poured in by degrees, stirring gently as this is done. When the bath begins to boil, a pattern of cloth, weighing about two ounces or less, is to be put in, moving it about rather quickly at first, and afterwards from time to time more slowly. The pattern must be boiled one hour and a half, then taken out, cooled, washed in a bason of clear water, and hung up to dry where it will not be exposed to dust or dirt of any kind. It will now be prepared for the dye, *instructions* for which will be given in a subsequent chapter. To dyers accustomed to prepare cloth on a large scale, any directions for the boiling will be unnecessary.

OF THE PREPARATION OF THE SOLUTION OF LAC LAKE FOR THE COLOURING BATH.

The squares of lac lake should be thrown into a vessel of warm water, and after remaining a short time, well brushed with a clean brush kept for the purpose, in order to clean off any dust or dirt adhering to the surface; rinsing them out afterwards in fresh water. The lake is then to be reduced to a very fine powder in a mortar,* and passed through a sieve: the finer the powder, the more easily and more completely will the colour dissolve.

An equal weight of refined borax is next to be powdered separately, but not sifted, and the powdered lake returned into the mortar upon the borax, working the pestle till they are well mixed with each other.

Before proceeding to the method of preparing the colouring bath, it is necessary to remark, that the quantity of colouring matter in the same weight of different kinds of lac lake is not always the same; although I am convinced it does not vary so much in this respect as cochineal: I will suppose, however, that we are operating with such as possesses the characteristic marks formerly described: In that case, the proportions to be observed on the different scales may be as follows.

Cloth.	Water.	Lake and Borax.	
1 oz.	1 quart	1 drm. Lake 1 drm. Borax	or 2 drms. of mixed powder.
8 oz.	2 gallons	1 oz. Lake 1 oz. Borax	or 2 oz. ditto
1 lb.	4 gallons	2 oz. Lake 2 oz. Borax	or 4 oz. ditto
20 lbs.	80 gallons	$2\frac{1}{2}$ lbs. Lake $2\frac{1}{2}$ lbs. Borax	or 5 lbs. ditto

The proportion of lac lake prescribed above, is more than is used of the *best* cochineal, for the same weights of cloth; but I believe it does not much exceed the quantity of cochineal em-

* Those mortars manufactured and sold by Mr. Mist, of Fleet-street, answer the purpose better than any other, not being subject to abrasion, nor attackable by acids.

ployed by our best dyers for full and deep colours; and without knowing the practice of different dye-houses it is impossible for me to speak with certainty on this point. Besides, the grounds that remain in the vessel in which the lake is dissolved, contains a considerable quantity of colour.

I have before stated that a glazed earthen vessel should be procured for the purpose of making the solution of the colour.* Into this vessel is to be put that proportion of the mixed powder necessary for the cloth to be dyed, and half the quantity of water mentioned above, (previously heated to the boiling point) poured upon it. When all the water is poured in, it should be stirred well about a minute,† the lid put on, and covered with thick cloths to retain the steam and heat. It should be left to rest and digest for fifteen minutes and then stirred, covered up for fifteen minutes more, and then stirred again. After this, it should remain undisturbed for half an hour at least, to let the grounds settle to the bottom, before it is drawn off into the boiler.

Only half the quantity of water prescribed for the dyeing bath has been recommended for making this solution, having generally found that the whole quantity weakened the power of the solvent too much.

The grounds that remain at the bottom of the vessel in which the solution was made, will still be found to contain a quantity of colour, more or less, according to the fineness of the powder to which the lake was reduced, and the care with which the solution was conducted, as well as to the qualities of the lake itself, which is seldom entirely soluble by borax. After the solution by the borax has been drawn off into the boiler, a small portion of the grounds that remain, must be taken out, and put into a glass tumbler with (as near as can be guessed if the grounds were dry) an equal weight of powdered *borax*: boiling water should then be poured on them in the proportion of one pint to a dram of

* Having only employed a vessel of this kind, is the reason I mention it exclusively, probably a wooden or metal one would answer as well.

† For stirring the solution I should prefer a pole of fir, because other wood may contain principles injurious to the colour.

borax; if the grounds are soluble by these means, it will immediately be seen, and they should be treated exactly in the same manner as at first: but if no colour is taken up by the liquid, the grounds will be found to be soluble in the solution of tin, which may be mixed with them in a proportion *not* exceeding under any circumstances, the original weight of the compound powder, the quantity to be determined by that of the colouring matter which appears to remain in the undissolved grounds; they should be ground together in the mortar, and then returned into the dissolving vessel to be diluted with warm water sufficient to form the bath, and after stirring the mixture well, immediately drawn off into the boiler *without* allowing it to settle; operating on the cloth with this bath in the same way as with the former one; and not adding any more solution of tin, unless it appears to be absolutely necessary, but cream of tartar must be added, at the expiration of fifteen minutes, in the same proportion as to the former bath.

Although from this bath the finest colour ought not to be expected, yet I have freqently produced tints from it very little inferior, sometimes equal to any I have ever seen.

I have directed the mixture for this bath to be drawn off into the boiler, immediately after having been stirred, and without allowing it to settle: because the solution of tin after dissolving the colour, lets it precipitate slowly, and most minutely divided; for this reason, I am of opinion that a small quantity of starch added to this bath would be very advantageous, inasmuch as it would contribute to keep the colouring particles longer suspended in the liquid, to dye cloth more evenly, and to assist it in depriving the bath more effectually of its colour.

I have found it exceedingly advantageous, expeditious, and economical, to pour the subsequent solution or mixture in the composition, into the first exhausted bath after the finer colours have been dyed in it; but in this case, the quantity of composition used for the solution of the grounds must be lessened, and very little warm water employed to dilute it; the quantity of tartar also must be reduced, because a considerable portion of

these matters remain in the first exhausted bath, and too much of them would be very injurious.

OF DYEING SCARLET IN THE COLOURING BATH PREPARED WITH LAC LAKE.

The remaining half of the water required for this bath, as mentioned in the preceding chapter, is to be put into the boiler,* and when a little more than warm, the solution of lac lake is to be poured in, taking care in drawing off the last portion to stop the vessel a little towards the cock, and also that no part of the grounds should mix with it.

When this bath is near boiling, a quantity of solution of tin, equal in weight to the mixed powder, or *twice the weight of the lac lake*, is to be poured in, stirring the bath gently. When it begins to boil, the cloth must be put in, moving it at first very quickly by means of the roller, until the cloth has run its whole extent backwards and forwards several times, after which, it may be moved more slowly. Having boiled for a quarter of an hour, the cloth is either to be lifted out and placed on the scraw, or wound rapidly on the roller. A quantity of cream of tartar in very fine powder, *one-fourth the weight of the lac lake*, is then to be added to the bath, stirring it briskly. In five minutes from the time it was taken out, the cloth must be returned into the bath, and moved again quickly for a few turns, and afterwards more slowly. It must now be kept boiling moderately for one hour and fifteen minutes, making the whole time it has boiled one hour and a half, a little longer or a little shorter according to the depth of colour required.

For colouring the small pattern mentioned in the fifth chapter one ounce of the mixed powder of lac lake and borax is to be put into a jug, and two quarts of boiling water out of a kettle poured on it by degrees; having previously taken care that the kettle was clean, and the water pure: it would also be proper to let the water settle in the kettle eight or ten minutes after it is taken off the fire, and before it is poured into the jug. After

* The boiler should be of block tin, or of copper well tinned.

stirring the liquid from time to time for a quarter of an hour, covering the jug always after it is stirred, it should be left to settle undisturbed for half an hour, at the end of which time it may be poured into the earthen pan in which the boiling with the mordant was performed, having previously washed the pan very clean, and warmed two quarts of water in it to complete the quantity necessary for the bath, and being cautious that no part of the grounds in the jug should mix with the solution as it is poured out. When this bath is ready to boil, an ounce of the composition is to be poured in and stirred. Some minutes afterwards the pattern of cloth should be put in, moving it about quickly at first. After being in the bath about a quarter of an hour or less, it must be taken out and one dram of fine cream of tartar added to the bath, which must be stirred for two or three minutes, and then the cloth returned and boiled for about an hour and a quarter, moving it about during this time frequently and slowly. If it is desired that the shade should be light, it must not boil so long.

The pattern is now to be taken out, cooled, rinsed in a bason of cold water, and hung up to dry with the same precautions, in securing it from dust and dirt, as mentioned in drying it after the boiling.

AN EXCELLENT COLOURLESS COPAL VARNISH.

By Mr. LENORMAND, *late Professor of Natural Philosophy.**

EVERY one knows the difficulty of dissolving copal completely, when we attempt to make a varnish, I hasten therefore to communicate a method, that has succeeded perfectly with me; and which will be found, to produce a very fine varnish with this substance.

All copal is not fit for making this varnish, it must therefore be selected with care, and the following method will show what is good. Take each piece of copal separately, and let fall on it

* Sonnini's Bibliothèque Physico-économique for 1808, Vol. II. p. 133.

a single drop of very pure essential oil of rosemary, not altered by keeping. Those pieces on which the oil makes a certain impression, that is to say, which soften at the part that imbibes the oil, are good, and should be reserved for making varnish. The other ought to be rejected.

Powder the pieces of copal thus selected, sift the powder through a very fine hair sieve, and put it into a glass, on the bottom of which it must not lie more than a finger's breadth thick. On it pour essence of rosemary to a similar height, stir the whole together with a stick for a few minutes, the copal will dissolve into a viscous substance, and the whole will form a very thick fluid. Let it stand for a couple of hours, after which pour on gently two or three drops of very pure alcohol, which you will distribute over the oily mass by inclining the glass in different directions with a very gentle motion. In this way you will effect their incorporation. Repeat this operation by little and little, till the varnish is reduced to a proper degree of fluidity. Remember, the first drops of alcohol are the most difficult, and require the longest time to incorporate; and that the difficulty diminishes as each successive addition is incorporated, or as the mass approaches the state of saturation.

When the varnish has attained the suitable degree of fluidity, it is to be suffered to stand a few days; and when it has become very clear, the varnish is to be decanted off.

The magma that remains at the bottom may still be rendered useful, by pouring on alcohol in the manner directed above; but care must be taken, to add very little at a time.

This varnish is made without heat, is very clear and colourless, may be applied with equal success on pasteboard, wood, and metals, and may be worked and polished with ease, indeed better than any known varnish. It may be used on paintings, and singularly heightens their beauty.

PAPERS ON

RURAL AND DOMESTIC ECONOMY.

REMEDY FOR THE PEACH WORM.

By Mr. JOHN H. COCKE.

For the Archives of Useful Knowledge.

Bremo, Fluvanna County, (Virg.) May, 1812.

SIR,

THE information which you have diffused throughout the United States by your publications on subjects of rural economy, establish a high claim to the gratitude of American agriculturalists; and as there is no return so acceptable to the enlightened labourer for the public good, as contributions, however small, which enable him to add to the stock of useful information, no apology is therefore deemed necessary for a stranger's addressing you, who presumes he may add a mite to the contents of the *Archives*.

A remedy against the insect which deposits its eggs in the bark of the peach tree, has become an object of importance in the cultivation of this valuable fruit. The peach trees all over Virginia have experienced the destructive effects of this insect, and accordingly various remedies have been tried, some of which for a time have promised success, but finally issued in disappointment. The fly or insect lays its eggs in the bark of the tree, just at the surface of the earth, where the rougher and harder bark which is exposed to atmospherical influences, begins to change to the softer character of that which envelops the roots. In this particular part the insect is able to puncture the surface, and there introduces its eggs. This they perform in our climate from the middle of July, through August and September. I have some where seen it stated, perhaps in the transactions of the Philadelphia Agricultural Society, that this insect deposits its

eggs in the spring as well as the latter part of summer and first of autumn. I have never known them to exist in the fly state sooner than the last of July, but chiefly in August and September. In August for the most part, I find the worms have assumed the chrysalis state, and soon after, say 8 or 10 days, are transformed into flies, and then they immediately begin to deposit their eggs, which are soon hatched into worms, and thus the round of transformation, common to the insect tribe, is completed. While in the worm state they do the mischief, by preying upon the soft inner bark of the tree, which is the medium of circulation for the sap; thus interrupting the flow of the sap. The immediate consequence of which is the destruction of the fruit, and finally the destruction of the tree.

I think I have discovered a remedy for this mischievous insect, in tobacco. As much cured tobacco as is tied up in a bundle for prizing (that is from four to six leaves) is sufficient for a tree. The tobacco, in a moist state, so as to render it flexible, is bound around the body of the tree just at the surface of the earth, encircling the part where the flies deposit their eggs. This precaution is to be taken a little before the hatching of the flies; the middle of July I find is early enough here. I do not attribute the success of this remedy to its covering the vulnerable part of the tree merely; for in using common straw and other coverings in a similar way, I failed. In those cases, the fly would get as close to its favourite region, as the covering would permit, and finding some fissure in the bark, would there deposit its eggs; but the tobacco, which in its essential qualities is so generally deleterious to the insect tribe, is so also, I suppose, to this destsuctive fly, and thereby prevents its approach. Be this however as it may, I will go on to detail my experience as to the fact. I made my first experiments with tobacco three years past this summer, and was led to them by a previous knowledge of its destructive effects on the moth, cabbage-lice, &c. I had been disappointed in many of the remedies which, upon obtaining the transactions of the Philadelphia Agricultural Society, I found judge Peters and others had tried with similar disappoint-

ment: such as exposing the roots to frost, wrapping the bodies in straw, &c. &c. My first experiments with tobacco were confined to 10 or 12 trees: the next spring, I found that the trees still threw out gum at the surface of the earth, and I apprehended my experiment had failed; upon a close examination, however, I perceived that the gum had issued from the old wounds of the worms of the former year, which were not yet entirely healed. The succeeding summer I extended the experiment to all my peach trees of favourite selected fruit, consisting of between 50 and 100 trees; and the same result was observed as in the preceding spring: in many cases gum issuing from the old wounds, but no worms in any instance where the tobacco had been applied. The last summer I again applied the tobacco upon a still larger scale; and this spring have assiduously examined the trees. I find, that those which have had the benefit of the tobacco application two successive years, have all their wounds entirely healed, and throw out no gum, and in no instance have I found the worm to have existed where the tobacco has been used.

I am, Sir, yours respectfully,

JNO. H. COCKE.

Dr. Mease,
Philadelphia.

IMPROVEMENT IN ARGAND'S LAMP.

THE advantages of the Argand lamp, are derived from the circular shape of the wick, by which a current of air rushes through the cylinder on which it is placed, and together with that which has access to the outside, excites a flame to such a degree, that the smoke is entirely consumed. Thus both the light and heat are much increased, the combustion being augmented by the quantity of air admitted to the flame; and what in common lamps is dissipated in smoke, is in this converted into a brilliant flame. The defects in this lamp are, that the reservoir for the oil being at a distance from the burning body, occasions

in cold weather, a coagelation of fluid, so as to prevent its flowing freely, and the brilliancy of the light is greatly diminished; another circumstance which lessens its value is, that only the best oil can be successfully used in it, because, from its construction, the sediment of impure oil clogs the wick, and renders the light dim. To remedy these defects, Mr. John Turmeau, and Charles Seward, of Cheapside, have contrived another lamp of a more simple form. In this there are neither fountains, valves, nor tubes, by which the oil can be impeded in its progress to the wick: the distance between the reservoir for the oil and flame, is such as to favour the ascent of the oil in the wick, and likewise to keep the oil in a perfectly fluid state even in the severest frost: instead of one cylindrical wick, there are three flat wicks placed in the chords of a circle, with a wide space for the admission of air between each: besides this, there is a current of air admitted through the body of the lamp to the centre of the wick-circle, and the glass chimney is elevated about an inch above the flame, by which means the greatest possible quantity of atmospheric air is thrown upon the flame; of course there is an abundant supply of oxygen, which occasions the complete combustion of all the inflammable matter, the whole of the smoke is consumed, and the most brilliant light that can be conceived is produced. It is called the "Liverpool Lamp." *Monthly Mag. London, January* 1812.

TO CONVEY FISH.

CRUMB of bread is to be soaked in brandy, and when well swelled, the fish's mouth is filled therewith, into which a half glass more of the spirit is then to be poured. The fish remains motionless, and as if deprived of life, in which state it is to be wrapped in fresh straw, and afterwards in a cloth. In this condition they may be kept, or conveyed to any distance for 8 or 10 days. When arrived at the place of destination, they must be unpacked, and thrown into a cistern of water, where they remain a quarter of an hour, or sometimes an hour, without shewing any

signs of life; but at the end of that time they disgorge very abundantly, and recover their life and ordinary motions.*

Catfish may be conveyed in a cart for many miles, by being surrounded with fresh grass, provided spring water is frequently dashed over them. The journey ought to be commenced a little before day, so that the fish may be put into the pond destined for them, before the heat of the day.

Dr. Mitchill, of New York, relates that in 1790, he in company with another gentleman, transported yellow perch 40 miles, viz. from Rockonkoma pond in Suffolk county, to Success pond in North Hempstead, Long Island. Three dozen of those which had been most superficially wounded by the hook were taken, and all except two swam away when put into the pond. A large churn was filled with the water of their native pond, and so few fishes put in, that there was no necessity of changing it on the road, and afterwards driving steadily on a walk the whole distance, without stopping to refresh either man or horse. In two years these fishes multiplied so fast and became so numerous, that they might be caught with the hook in any part of the water, which is about a mile in circumference.†

TO DRY PEACHES.

The following mode of drying peaches is adopted by Thomas Belanjee, of Egg-Harbour, New Jersey.

HE has a small house with a stove in it, and drawers in the sides of the house, lathed at their bottoms. Each drawer will hold nearly half a bushel of peaches, which should be ripe, and not peeled, but cut in two and laid on the laths with their skins downwards so as to save the juice. On shoving the drawer in they are soon dried by the hot air of the stove and laid up. Peaches thus dried are clear from fly-dirt, excellently flavoured, and command a high price in market. Pears thus dried eat like rai-

* Nicholson's Philosophical Journal, Vol. 15, p. 263.

† Medical Repository, Vol. 3, p. 422.

sins. With a paring machine, which may be had for a dollar or two, apples or pears may be pared, and sufficient quantity dried, to keep a family in pies, and apple bread and milk, till apples come again. With a paring machine, one person can pare for five or six cutters.

TO DESTROY WEEVILS IN BARNS.

By Mr. Gavin Scott, *of Elizabeth-town, New Jersey.*

I WAS much infested with weevils in my barn, &c. and did not know how to get rid of them, till I found tobacco was an effectual remedy. They are fond of it, eat it, and go off and die. I deal in tobacco, and receiving two hogsheads (for which I had not room in my cellar at the time) I put them into the barn. On removing them, I found thousands of dead weevils on the barn-floor, which cleared it entirely of that destructive animal. I then took two or three boxes, containing about six pounds of tobacco in each, and placed them in my granary, where I kept wheat, &c. This was soon cleared also, and I have not had any since. The boxes ought to be open enough to let the weevils have free passage into them.

December, 28, 1808.

The good effects of tobacco leaves strewed about a barn or granary, in killing weevils, have been recently confirmed to the Editor by an agricultural friend.

TO MAKE CIDER-OIL.

THIS liquor is a very favourite drink with a large portion of our German citizens, and of an agreeable flavour, when diluted, to most persons. The following receipt has been communicated to the Editor by a person well acquainted with the mode of compounding the liquor.

The cider must be well racked two or three times in clear

weather. Four gallons of best apple-brandy are then to be added to each barrel of cider, if the cider be weak, but if it be strong, less will suffice. An infusion of Sassafras root, made by putting a piece of about the size of a finger, and chipped fine, into a pint of water, improves the flavour. The barrel is then to be rolled.

In years when apples are abundant, cider even of a good quality brings only a small price; but by converting it into cider-oil, it may be preserved until the following spring, and will then commonly sell well.

ON THE REVIVAL OF AN OBSOLETE MODE OF MANAGING STRAWBERRIES.

By the right hon. Sir JOSEPH BANKS, *Bart. K.B. P.R.S. &c.**

THE custom of laying straw under strawberry plants, when their fruit begins to swell, is probably very old in this country: the name of the fruit bears testimony in favour of this conjecture, for the plant has no relation to straw in any other way, and no other European language applies the idea of straw in any shape to the name of the berry, or to the plant that bears it.

When Sir Joseph Banks came to Spring Grove, in 1779, he found this practice in the garden: John Smith, the gardener, well known among his brethren as a man of more than ordinary abilities in the profession, had used it there many years; he learned it soon after he came to London from Scotland; probably at the Neat Houses, where he first worked among the market gardeners, it is therefore clearly an old practice, though now almost obsolete.

Its use in preserving a crop is very extensive: it shades the roots from the sun; prevents the waste of moisture by evaporation, and consequently, in dry times, when watering is necessary, makes a less quantity of water suffice than would be used if the

* From Transac. of the Horticultural Society, London, Vol. I, Part I, p. 57.

sun could act immediately on the surface of the mould; besides, it keeps the leaning fruit from resting on the earth, and gives the whole an air of neatness as well as an effect of real cleanliness, which should never be wanting in a gentleman's garden.

The strawberry beds in that garden at Spring Grove, which has been measured for the purpose of ascertaining the expense incurred by this method of management, are about 75 feet long, and five feet wide, each containing three rows of plants, and of course requiring four rows of straw to be laid under them. The whole consists of 600 feet of beds, or 1800 feet of strawberry plants, of different sorts, in rows. The strawing of these beds consumed this year, 1806, the long straw of 26 trusses, for the short straw being as good for litter as the long straw, but less applicable to this use, is taken out; if we allow then, on the original 26 trusses, six for the short straw taken out and applied to other uses, 20 trusses will remain, which cost this year 10*d.* a truss, or 16*s.* 8*d.* being one penny for every nine feet of strawberries in rows.

From this original expenditure the value of the manure made by the straw when taken from the beds must be deducted, as the whole of it goes undiminished to the dung-hill as soon as the crop is over. The cost of this practice, therefore, cannot be considered as heavy; in the present year not a single shower fell at Spring Grove, from the time the straw was laid down till the crop of scarlets was nearly finished, at the end of June. The expense of strawing was therefore many times repaid by the saving made in the labour of watering, and the profit of this saving was immediately brought to account in increase of other crops, by the use of water spared from the strawberries; and besides, the berries themselves were, under this management, as fair and nearly as large as in ordinary years, but the general complaint of the gardeners this year was, that the scarlets did not reach half their natural size, and of course required twice as many to fill a pottle as would do it in a good year.

In wet years the straw is of less importance in this point of view, but in years moderately wet, the use of strawing some-

times makes watering wholly unnecessary, when gardeners who do not straw are under the necessity of resorting to it; and we all know if watering is once begun, it cannot be left off till rain enough has fallen to give the ground a thorough soaking.

Even in wet years the straw does considerable service: heavy rains never fail to dash up abundance of mould, and fix it upon the berries, this is entirely prevented, as well as the dirtiness of those berries that lean down upon the earth, so that the whole crop is kept pure and clean: no earthy taste will be observed in eating the fruit that has been strawed, and the cream which is sometimes soiled when mixed with strawberries, by the dirt that adheres to them, especially in the early part of the season, will retain to the last drop that unsullied red and white, which give almost as much satisfaction to the eye while we are eating it, as the taste of that most excellent mixture does to the palate.

REMARKS.

Upon mentioning the use of straw to a gardener, (G. Esher,) who is well known for raising very large and very fine strawberries, he said that he had been induced to use straw, from supposing that in a dry season, it would keep the ground moist, and that in wet weather, the soil would be prevented from being splashed up on the fruit. He had not seen the practice recommended in any book. The first year he was pleased with the experiment, but the second year, after he was done picking, the vines were so much destroyed by grasshoppers and crickets, that he calculates his loss at $500, and he was obliged to renew his beds. The gardener of a neighbouring gentleman also tried the straw, and with the same unfortunate results. It is now four years since the straw was first used, and he has not yet been able to clear his garden of the destructive pests. They begin their depredations about August, and only attack the vines of the third year. The plan fallen upon by Mr. Esher, to subdue the insects, is to mow off the vines close immediately after the season for picking is over, to pull out the runners and weeds, and to

clean up the beds in the neatest manner, so as to give no harbour to them. In the room of straw, he spreads green grass, *(poa viridis)* and with good effect. Probably if the vines had been mowed, and the rotten straw carefully raked off, the insects by being deprived of a harbour, would not have appeared.

Editor.

ON THE ECONOMY OF BEES.

In a letter from Thomas Andrew Knight, *Esq. F. R. S. to the right hon. Sir Joseph Banks, Bart. K. B. P. R. S.**

MY DEAR SIR,

IN the prosecution of those experiments on trees, accounts of which you have so often done me the honour to present to the Royal Society, my residence has necessarily been almost wholly confined to the same spot; and I have thence been induced to pay considerable attention to the economy of bees, amongst other objects; and as some interesting circumstances in the habit of these singular insects appear to have come under my observation, and to have escaped the notice of former writers, I take the liberty to communicate my observations to you.

It is, I believe, generally supposed, that each hive, or swarm, of these insects remains at all times wholly unconnected with other colonies in the vicinity; and that the bee never distinguishes a stranger from an enemy. The circumstances which I shall proceed to state, will, however, tend to prove, that these opinions are not well founded, and that a friendly intercourse not unfrequently takes place between different colonies, and is productive of very important consequences in their political economy.

Passing through one of my orchards rather late in the evening, in the month of August, in the year 1801, I observed, that several bees passed me in a direct line from the hives in my own

* Philosophical Transactions for 1807, Part II, p. 234.

garden to those in the garden of a cottager, which was about a hundred yards distant from it. As it was considerably later in the evening than the time when bees usually cease to labour, I concluded that something more than ordinary was going forward. Going first to my own garden, and then to that of the cottager, I found a very considerable degree of bustle and agitation to prevail in one hive in each: every bee, as it arrived, seemed to be stopped and questioned, at the mouth of each hive; but I could not discover any thing like actual resistance, or hostility, to take place; though I was much inclined to believe the intercourse between the hives to be hostile and predatory. The same kind of intercourse continued, in a greater or less degree, during eight succeeding days, and though I watched them very closely, nothing occurred to induce me to suppose, that their intercourse was not of an amicable kind. On the tenth morning, however, their friendship ended, as sudden and violent friendships often do, in a quarrel; and they fought most furiously; and after this there was no more visiting.

Two years subsequent to this period, I observed the same kind of intercourse to take place between two hives of my own bees, which were situate about two hundred yards distant from each other: they passed from each hive to the other just as they did in the preceding instance, and a similar degree of agitation was observable. In this instance, however, their friendship appeared to be of much shorter duration, for they fought most desperately on the fifth day; and then, as in the last mentioned case, all further visiting ceased.

I have some reason to believe, that the kind of intercourse I have described, which I have often seen, and which is by no means uncommon, not unfrequently ends in a junction of the two swarms; for one instance came under my observation, many years ago, in which the labouring bees, under circumstances perfectly similar to those I have described, wholly disappeared, leaving the drones in peaceable possession of the hive, but without any thing to live upon. I have also reasons for believing, that whenever a junction of two swarms, with their property, is

agreed upon, that which proposes to remove, immediately, or soon afterward, unites with the other swarm, and returns to the deserted hive during the day only to carry off the honey: for having examined at night a hive from which I suspected the bees to be migrating, I found it without a single inhabitant. I was led to make the examination by information I had received from a very accurate observer, that all the bees would then be absent. A very considerable quantity of honey was in this instance left in the hive without any guards to defend it; but I conclude, that the bees would have returned for it, had it remained till the next day. Whenever the bees quit their habitation in this way, I have always observed some fighting to take place; but I conceived it to be between the bees of the adjoining hives, and those which were removing; the former being attracted by the scent of the honey, which the latter were carrying off.

On the farm which I occupy, there were formerly many old decayed trees, the cavities of which were frequently occupied by swarms of bees; and when these were destroyed, a board was generally fitted to the aperture, which had been made to extract the honey; and the cavity was thus prepared for the reception of another swarm, in the succeeding season. Whenever a swarm came, I constantly observed, that about fourteen days previous to their arrival, a small number of bees, varying from twenty to fifty, were every day employed in examining, and apparently in keeping possession of the cavity; for if molested, they showed evident signs of displeasure, though they never employed their stings in defending their proposed habitation. Their examination was not confined to the cavity, but extended to the external parts of the tree above; and every dead knot particularly arrested their attention, as if they had been apprehensive of being injured by moisture, which this might admit into the cavity below; and they apparently did not leave any part of the bark near the cavity unexamined. A part of the colony, which purposed to emigrate, appeared in this case to have been delegated to search

for a proper habitation;* and the individual who succeeded must have apparently had some means of conveying information of his success to others; for it cannot be supposed, that fifty bees should each accidentally meet at and fix upon, the same cavity, at a mile distant from their hive, which I have frequently observed them to do, in a wood where several trees were adapted for their reception; and indeed I observed, that they almost uniformly selected that cavity, which I thought best adapted to their use.

It not unfrequently happened, that swarms of my own bees took possession of these cavities, and such swarms were in several instances followed from my garden to the trees: and they were observed to deviate very little from the direct line between the one point and the other; which seems to indicate, that those bees, which had formerly acted as purveyors, now became guides.

Two instances came under my own observation, in which a swarm was received into a cavity, of which another swarm had previous possession. In the first instance I arrived with the swarm, and I could not discover, that the least opposition was made to their entrance: in the second instance, observing the direction that the swarm took, I used all the expedition I could to arrive first at the tree, to which I supposed they were going, whilst a servant followed them; and a descent of ground being in my favour, and the wind against them, I succeeded in arriving at the tree some seconds before them; and I am perfectly confident, that not the least resistance was opposed to their entrance.

Now it does not appear probable, that animals so much attached to their property as bees are, so jealous of all approach towards it, and so ready to sacrifice their lives in defence of it, should suffer a colony of strangers, with whose intentions they were unacquainted, to take possession, without making some effort to defend it: nor does it seem much more probable, that

* The Editor heard this opinion, supported by some farmers in Pennsylvania, several years since; and whoever will attend to the precise and direct manner in which a swarm flies to a distant hollow tree, will not be able to account for the fact upon any other principle.

the same animals, which spent so much time in examining their future habitation, in the cases I have mentioned, should have attempted in this case to enter without knowing whether there was space sufficient to contain them, and without any examination at all. I must therefore infer, that some previous intercourse had taken place between the two swarms, and that those in the possession of the cavities were not unacquainted with the intentions of their guests; though the formation of any thing like an agreement between the different parties, be scarcely consistent with the limitations generally supposed to be fixed by nature to the instinctive powers of the brute creation.

Brutes have evidently language; but it is a language of passion only, and not of ideas. They express to each other sentiments of love, of fear, and of anger; but they appear to be wholly incapable of transmitting to each other any ideas they have received from the impression of external objects. They convey to other animals of their species, on the approach of an enemy, a sentiment of danger; but they appear wholly incapable of communicating what the enemy is, or the kind of danger apprehended. A language of more extensive use seems, from the preceding circumstances, to have been given to bees; and if it be not, in some degree, a language of ideas, it appears to be something very similar.

When a swarm of bees issues from the parent hive, they generally soon settle on some neighbouring bush or tree; and as in this situation they are generally not at all defended from rain or cold, it is often inferred, that they are less amply gifted with those instinctive powers, that direct to self-preservation, than many other animals. But their object in settling soon after they leave the hive is apparently nothing more than to collect their numbers; and they have generally, I believe always, another place to which they intend subsequently to go: and if the situation they select be not perfectly adapted to secure them from injuries, it is probably, in almost all instances, the best they can discover. For I have very often observed, that, when one of my hives was nearly ready to swarm, one of the hollow trees I have

mentioned (and generally that best adapted for the accommoda-tion of a swarm) was every day occupied by a small number of bees; but that after the swarm had issued from that hive, and had taken possession of another, the tree was wholly deserted; whence I inferred, that the swarm, which would have taken possession of the cavity of that tree, had relinquished their intended migration, when a hive was offered them at home. And I am much disposed to doubt, whether it be not rather habit, produced by domestication, during many successive generations, than any thing inherent in the nature of bees, which induces them to accept a hive, when offered them, in preference to the situation they have previously chosen: for I have noticed the disposition to migrate to exist in a much greater degree in some families of bees than in others; and the offspring of domesticated animals inherit, in a very remarkable manner, the acquired habits of their parents. In all animals this is observable: but in the dog it exists to a wonderful extent; and the offspring appears to inherit not only the passions and propensities, but even the resentments of the family from which it springs. I ascertained by repeated experiment, that a terrier, whose parents had been in the habit of fighting with polecats, will instantly show every mark of anger, when he first perceives the scent of that animal; though the animal itself be wholly concealed from his sight. A young spaniel brought up with the terriers showed no marks whatever of emotion at the scent of the polecat; but it pursued a woodcock, the first time it saw one, with clamour and exultation: and a young pointer, which I am certain had never seen a partridge, stood trembling with anxiety, its eyes fixed, and its muscles rigid, when conducted into the midst of a covey of those birds. Yet each of these dogs is a mere variety of the same species; and to that species none of these habits are given by nature. The peculiarities of character can therefore be traced to no other source than the acquired habits of the parents, which are inherited by the offspring, and become what I shall call instinctive hereditary propensities. These propensities, or modifications of the natural instinctive powers of animals, are capable of endless

variation and change; and hence their habits soon become adapted to different countries and different states of domestication, the acquired habits of the parents being transferred hereditarily to the offspring. Bees, like other animals, are probably susceptible of these changes of habit, and thence, when accustomed through many generations to the hive, in a country which does not afford hollow trees, or other habitations adapted to their purpose, they may become more dependent on man, and rely on his care wholly for a habitation; but in situations where the cavities of trees present to them the means of providing for themselves, I have found, that they will discover such trees in the closest recesses of the woods, and at an extraordinary distance from their hives; and that they will keep possession of such cavities in the manner I have stated: and I am confident that, under such circumstances, a swarm never issues from the parent hive, without having previously selected some such place to retire to.

It has been remarked by Mr. John Hunter, that the matter which bees carry on their thighs is the farina of plants, with which they feed their young, and not the substance with which they make their combs; and his statement is, I believe, perfectly correct: but I have observed, that they will also carry other things on their thighs. I frequently covered the decorticated parts of trees on which I was making experiments, with a cement composed of bees-wax and turpentine; and in the autumn I have frequently observed a great number of bees employed in carrying of this substance. They detached it from the tree with their forceps, and the little portion thus obtained was then transferred by the first to the second leg, by which it was deposited on the thigh of the third: the farina of plants is collected and transferred in the same manner. This mixture of wax and turpentine did not, however, appear to have been employed in the formation of combs; but only to attach the hive to the board on which it was placed, and probably to exclude other insects, and air during winter. Whilst the bees were employed in the collection of this substance, I had many opportunities of observing the peaceful and patient disposition of them as individuals, which Mr. Hunter has also, in

some measure noticed. When one bee had collected its load, and was just prepared to take flight, another often came behind it, and despoiled it of all it had collected. A second, and even a third load was collected and lost in the same manner, and still the patient insect pursued its labour, without betraying any symptoms of impatience or resentment. When, however, the hive is approached, the bee appears often to be the most irritable of all animals; but a circumstance I have observed amongst another species of insects, whose habits are in many respects similar to those of bees, induces me to believe, that the readiness of the bees to attack those who approach their hives, does not in any degree spring either from the sense of injury, or apprehensions of the individual, who makes the attack. If a nest of wasps be approached without alarming its inhabitants, and all communication be suddenly cut off between those out of the nest and those within it, no provocation will induce the former to defend their nest, or themselves. But if one escape from within, it comes with a very different temper, and appears commissioned to avenge public wrongs, and prepared to sacrifice its life in the execution of its orders. I discovered the circumstance, that wasps thus excluded from their nest would neither defend it nor themselves, at a very early period of my life; and I profited so often, by the discovery, as a schoolboy, that I am quite certain of the fact I state; and I do not entertain any doubt, though I speak from experiments less accurately made, that the actions of bees, under similar circumstances, would be the same.

Mr. Hunter conceived bees-wax to be an animal substance, which exuded between the scales of the belly of the insect; but I am strongly disposed to believe that it is collected from plants, and merely deposited between the scales of the belly of the bee, for the joint purposes of being carried with convenience, and giving it the temperature necessary for being moulded into combs: and I am led to this conclusion, not only by the circumstance of wax being found in the vegetable world, but also by having often observed bees employed in detaching something from the bases of the leaves of plants with their forceps, which

they did not deposit on their thighs, as they do (I believe invariably) the farina of plants. I have also frequently observed the combs of very late swarms to be remarkably thin, and white, and brittle; which are circumstances very favourable to the conclusion, that the wax is a vegetable substance, for it would probably be less abundant during autumn than in summer; and that portion which had remained on the plants till late in the season would hence become more colourless by exposure to light, as well as more dry and brittle than when it first exuded; but were it an animal substance, there does not appear any reason, why it should be more dry and brittle, or less abundant, in the autumn, than in the spring and summer. The conclusions of Mr. Hunter are, however, always drawn with so much caution, and he united so much skill and science with the greatest degree of industry, that it is not without much hesitation and diffidence, that I venture to put my opinion in opposition to his authority.

Elton, *May* 4, 1807. T. A. KNIGHT.

ON THE UNEQUAL DURATION OF CANDLES.

FROM some recent experiments, it appears "that of all the different sizes of tallow candles, that called 'sixes to the pound' burn longest. A difference has also been found in the length of time which candles of the same size will burn. In one instance it is stated that a mould candle, six to the pound, made in New York, burnt six hours and forty-seven minutes; while one made at Hartford, burnt seven hours and seventeen minutes, making a difference in favour of the latter of one half hour in each candle, or of three hours in the pound." The difference in the qualities of the two candles arose in all probability from the nature of the fat employed in making them. Mutton suet, or the suet of oxen or cows fed with still wash, will not be so hard, and of course will not make such good candles as if the animals had been fed on grass or Indian corn.

PAPERS ON AGRICULTURE.

ON THE CULTIVATION AND MANUFACTURE OF WOAD.

In a letter to the Bath and West of England Agricultural Society.

By Mr. JOHN PARRISH.*

WOAD is a plant which, combined with indigo, gives the best and most permanent blue dye hitherto discovered. It is of great importance to our commerce, as well as to agriculture, being in nature one of the best preparers of land for a corn crop† that has hitherto been discovered; and, if the land is properly chosen for it, and well managed, will be found very profitable, more particularly at this time, when its price is advanced to almost an unprecedented degree: therefore I conceive that in rendering its cultivation and preparation better known and understood, it may be greatly beneficial to the nation.

I have been many years a considerable consumer of woad, and have also cultivated it with much success: and though I am well experienced in the usual method of its preparation, I was induced to depart from it in consequence of the great waste of its juices in the old method of grinding and balling. But I shall endeavour to give instructions for carrying on each process, and leave those who shall undertake it to proceed as they think best.

This plant is cultivated in different parts of England for the use of the dyers, as well as in France, Germany, &c. It is best to sow the seeds in the month of March, or early in April, if the season invite, and the soil be in condition to receive it; but it requires a deep loamy soil, and is better still with a clay bottom, such as is not subject to become dry too quickly. It must never be flooded, but situated so as to drain its surface, that it may not be poisoned by any water stagnant upon it.

If (at any reasonable price) meadow land to break the turf can

* From Vol. XII. of the Society's Letters and Papers. Bath, 1811.

† In England *corn* is the general term for grain of all kinds. *Editor.*

be obtained, it will be doubly productive. This land is generally freest from weeds and putrid matter, though sometimes it abounds with botts, grubs, and snails. However, it saves much expense in weeding; and judicious management will get rid of these otherwise destructive vermin. A season of warm showers, not too dry or too wet, gives the most regular crop, and produces the best woad.

If woad is sown on corn-land, much expense generally attends hoeing and weeding: and here it will require strong manure, though on leys it is seldom much necessary, yet land cannot be too rich for woad. On rich land dung should be avoided, particularly on leys, to avoid weeds. Some people sow it as grain, and harrow it in, and afterwards hoe it as turnips, leaving the plants at a distance in proportion to the strength of the land: others sow it in ranks by a drill-plough; and some dibble it in, (in quincunx form, by a stick with a peg crossways, about two or two and a half inches from the point, according to the land,) putting three or four seeds in a hole, and these holes to be from twenty inches to two feet apart, according to the richness of the land: for good land, if room be given, will produce very luxuriant plants in good seasons; but if too nearly planted, so that air cannot circulate, they do not thrive so well: attention to this is necessary in every way of sowing it. I have been most successful in this last process. Woad very often fails in its crop, from the land not being in condition, or from want of knowing how to destroy the botts, snails, wire-worms, &c. that so often prey upon and destroy it, as well as from inattention to weeding, &c. Crops fail also from being sown on land that is naturally too dry, and in a dry season; but as the roots take a perpendicular direction, and run deep, such land as I have described (with proper attention to my observations) will seldom fail of a crop: and if the season will admit sowing early enough to have the plants strong before the dry and hot weather comes on, there will be almost a certainty of a great produce.

These plants are frequently destroyed in the germination by flies, or animalculæ, and by grubs, snails, &c. as before observed;

and in order to preserve them, I have steeped the seeds with good success in lime and soot, until they began to vegetate; first throwing half a load or more of flour lime* on the acre, and harrowing it in. Then plant the seeds as soon as they break the pod, taking care not to have more than one day's seed ready; for it is better to be too early, than to have their vegetation too strong before it is planted, lest they should receive injury; yet I have never observed any injury in mine from this, though I have often seen the shoot strong. Either harrows or rollers will close the holes. If the ground be moist it will appear in a few days; but it will be safe, and a benefit to the land, to throw more lime on the surface, when, if showers invite snails and grubs to eat it, they will be destroyed, which I have several times found; particularly once, when the leaves were two inches long, and in drills very thick and strong, but the ground was dry. When a warm rain fell, in less than two hours I found the ranks on one side attacked by these vermin, and eaten entirely off by a large black grub, thousands of which were on the leaves, and they cleared as they went, not going on until they had destroyed every leaf where they fixed. They had eaten six or seven ranks before I was called by one of my people to observe it. Having plenty of lime, I immediately ordered it in flour to be strewed along those ranks which were not begun. This destroyed them in vast numbers, and secured the remainder. Another time, having had two succeeding crops on four acres of land, I considered it imprudent to venture another. However, as the land after this appeared so clean and rich, I again ventured, but soon found my error. On examining the roots (for after it had begun to vegetate strong, it was observed to decay and wither) I found thousands of the wire-worm at them, entwined in every root. I immediately strewed lime, (four loads of six quarters each, on the four acres,) and harrowed it; when rain coming on soon after, washed it in, and destroyed them all, and gave me an extraor-

* If the seeds are not sown within a day after the time, it will lose much effect.

dinary crop; but the first-sown side of the field, where they had begun, never quite recovered like the rest. And I am fully satisfied, that when the grub is seen in wheat, &c. the same treatment (if the weather suited) would destroy them all, as well as change the nature of the land. I need not enter on the wide and extensive field of observations on the causes of weeds, grubs, &c. (which so often counteract the labours of the husbandman,) that occur so differently in different seasons, and after different treatment and improper crops—further than to observe, that when your land has *not a proper change*, then it is that these are experienced in a more destructive degree.

Further, it is in vain to expect a good crop of woad, of a good quality, from poor and shallow land. The difference of produce and its value is so great, that no one of any experience will waste his labour and attention on such lands upon so uncertain a produce. Warm and moist seasons increase the quantity every where, but they can never give the principle which only good land affords.

In very wet seasons, woad from poor land is of very little value. I once had occasion to purchase at such a time, and found that there was no possibility of regulating my vats in their fermentation; and I was under the necessity of making every possible effort to obtain some that was the produce of a more congenial season. I succeeded at last; but I kept the other three and four years, when I found it more steady in its fermentation; but still it required a double quantity, and even then its effect was not like that from good woad.

At this time several dyers experienced much difficulty, and one of eminence in the blue trade suffered so much by woad of his own growth, that he declared his resolution to decline the trade altogether. When I pointed out to him that it was the woad that occasioned his bad blues, and that I had from the same defect purchased such other woad as would do, and informed him where he could get it,—he succeeded as usual. His own he disposed of to a drysalter, who sold it again somewhere in the country; and it occasioned such a cause of complaint, as

I believe rendered the claim of payment to be given up, or partly so: of this I am not certain, having it only from report. I mention this in order to give those who wish to become growers of woad, such information as may properly direct them.

The leaves of woad on good land in a good season grow very large and long, and when they are ripe show near their end a brownish spot inclining to a purple towards its centre, while other parts of the leaves appear green, but just beginning to turn of a more yellowing shade; and then they must be gathered, or they will be injured.

Woad is to be gathered from twice to four and even five times in the season, as I once experienced (it was an early and a late season,) and for the next spring I saved an acre for seed, of which I had a fair crop. I picked the young seedling sprouts off the rest, and mixed with my first gathering of what was newly sown; this was very good. During one season I let these shoots grow too long; the consequence was, that the fibrous parts became like so many sticks, and afforded no saponaceous juices. When you design to plant woad on the same land the second season, it should be as soon as your last gathering (before winter is finished) be ploughed; that is, as soon as the weather will permit, and in deep furrows or ridges, to expose and ameliorate it by the vegetative salts that exist in the atmosphere, and by frost and snow. This, in some seasons, has partly the effect of a change of produce; but if intended for wheat, the last gathering should not be later than September.

The land, after woad, is always clean, and the nature of the soil appears to be greatly changed in favour of the wheat crop; for I have always experinced abundant increase of produce after woad, and observed that it held on for some time, if proper changes were attended to, and good husbandry. Keeping land clean from weeds, certainly produces an increase of corn; but in the hoeing and gathering woad (for hoeing and earthing up the plants often renders them abundantly more prolific, even if there are no weeds), many nests of animalculæ are destroyed, as well as grubs and insects, which are destructive to vegetation.

All this is favourable to corn; but I am disposed to believe that woad in itself furnishes such a principle of change in favour of corn (and wheat in particular), as in a high degree to merit the attention of that Society who are so honourably united to promote and encourage the first interests of the British empire.

(To be concluded in the next number.)

ON RAISING NEW AND EARLY VARIETIES OF THE POTATO, (SOLANUM TUBEROSUM.)

By THOMAS ANDREW KNIGHT, *Esq. F. R. S. &c.**

THE potato contributes to afford food to so large a portion of the inhabitants of this country, that every improvement in its culture becomes an object of national importance; and thence I am induced to hope, that the following communication may not be unacceptable to the Horticultural Society.

Every person who has cultivated early varieties of this plant, must have observed that they never afford seeds, nor even blossoms; and that the only method of propagating them is by dividing their tuberous roots: and experience has sufficiently proved, that every variety, when it has been long propagated, loses gradually some of those good qualities, which it possessed in the earlier stages of its existence. Dr. Hunter, in his Georgical Essays, I think has limited the duration of a variety, in a state of perfection, to about fourteen years: and probably, taking varieties in the aggregate, and as the plant is generally cultivated, he is nearly accurate. A good new variety of an early potato is therefore considered a valuable acquisition, by the person who has the good fortune to have raised it; and as an early variety, according to any mode of culture at present practised, can only be obtained by accident from seeds of late kinds, one is not very frequently produced; but by the method I have to communicate, seeds are readily obtained from the earliest and best varieties;

* From the Transactions of the Horticultural Society, Vol. I, p. I, p. 57.

and the seeds of these, in successive generations, may, not improbably, ultimately afford much earlier and better varieties, than have yet existed.

I suspected the cause of the constant failure of the early potato to produce seeds, to be the preternaturally early formation of the tuberous root; which draws off, for its support, that portion of the sap, which, in other plants of the same species, affords nutriment to the blossoms and seeds; and experiment soon satisfied me, that my conjectures were perfectly well founded.

I took several methods of placing the plants to grow, in such a situation, as enabled me readily to prevent the formation of tuberous roots; but the following appearing the best, it is unnecessary to trouble the Society with an account of any other.

Having fixed strong stakes in the ground, I raised the mould in a heap round the bases of them; and in contact with the stakes, on their south sides, I planted the potatoes from which I wished to obtain seeds. When the young plants were about four inches high, they were secured to the stakes with shreds and nails, and the mould was then washed away, by a strong current of water, from the bases of their stems, so that the fibrous roots only of the plants entered into the soil. The fibrous roots of this plant are perfectly distinct organs from the runners, which give existence, and subsequently convey nutriment, to the tuberous roots; and as the runners spring from the stems only of the plants, which are, in the mode of culture I have described, placed wholly out of the soil, the formation of tuberous roots is easily prevented; and whenever this is done, numerous blossoms will soon appear, and almost every blossom will afford fruit and seeds. It appears not improbable, that by introducing the farina of the small, and very early varieties into the blossoms of those of larger size, and somewhat later habits, moderately early varieties, adapted to field culture, and winter use, might be obtained; and the value of these to the farmer in the colder parts of the kingdom, whose crop of potatoes is succeeded by one of wheat, would be very great. I have not yet made any experiment of this kind; but I am prepared to do it in the present spring.

ADDRESS

OF THE CATTLE SOCIETY OF PENNSYLVANIA, TO THE PUBLIC.

THREE years have now elapsed, since the Cattle Society of Pennsylvania was formed, and they are gratified in finding that their services to their country have met with a general acknowledgment, in consequence of the attention they have excited to the important subject which is the object of their deliberations. With the design of giving the zeal of their farming fellow-citizens a right direction, they published soon after they associated, an address, stating the necessity for establishing the Society, its objects and views, and offered sundry premiums for subjects, which, from their knowledge of the country, appeared of primary importance. Among these are the importation of certain well known breeds of cattle, possessing the all-important qualities of early maturity, of speedy fatting, or of rich milk; and the origination of similar breeds by selection from, or judicious crossings with, our domestic stock. It must be also acknowledged that they offered premiums for cattle of extraordinary weights of flesh and fat, and although they were aware that this measure laid them open to the censure of continuing a practice which has been abandoned by European improvers from discovering the errors that it led to, yet they may plead in excuse, their knowledge of the existence in different states at the time of some very large cattle, and they were desirous of knowing the extent of their capabilities; but in a general way, the society are convinced of the impropriety of encouraging farmers to keep cattle until over ripe, they being neither profitable to the feeder, nor essentially requisite for the purposes of life: two of the premiums last alluded to, have been awarded to citizens of New-Jersey;* and the

* For the particulars of the weights of those extraordinary large and fat oxen, see the "ARCHIVES OF USEFUL KNOWLEDGE," Vol. 1, p. 61, and Vol. 2, p. 61.

The Cattle Society bears the name of "*Pennsylvania,*" but they consider their premiums as open to the *inhabitants of the whole Union,* provided the cat-

subjects of them, while they constitute specimens of superior weights of flesh and fat, which it is confidently believed HAVE NEVER BEEN EQUALLED IN ANY COUNTRY, are also sufficient to prove the absurdity of that most absurd of all prejudices entertained by European writers, respecting the diminutive size of the animals of North America, when compared with those of Europe. So far, therefore, those premiums have not been unproductive of a good effect.

The Society conceive that it is now time to declare more fully their opinions on the subject for which they associated, viz.—*the improvement of the breed of cattle.*

The object of all grazing, of all farming, is profit—and this (as respects the first mentioned calling) they are decidedly of opinion is most effectually promoted, if beef be the object, by breeding or feeding animals of middle size (say from 700 to 1000 weight of beef) whose bodies are capacious, but barrel-shaped, backs straight, loins broad, head and neck small, chines full, leaving no hollow behind the shoulders; chaps clean, with bright and prominent eyes, and whose chests are deep, and project well before the legs; fore legs clean, straight, and standing wide; not knock-kneed (or in-kneed) hips wide and round; rump lying in a horizontal direction, *not sinking backwards;* the tail set on so high as to take in the same line with the back; and lastly, with small bones.* Animals of such forms will readily fatten to the above weights, and upwards, and lay the fat on parts that sell for the most money; and if properly attended to, and well supplied with food, will be fit to turn off in one season, when grass is done, and do credit to any market. Whereas, on the contrary, very large animals cannot be brought to market without three or four months, nay six months stall feeding, and this too, after two or more seasons of grazing; for all which, the

tle, which are the objects of those premiums, are either killed in Philadelphia, or sold, or kept in Pennsylvania. The funds, as yet, have exclusively been derived from Philadelphia, and its vicinity.

* The portrait of a Teeswater Bull, Vol. 1, p. 358, of the Archives, may be considered as a model of perfection in Cattle.

owner, however gratified his pride may be by the production of such cattle, is seldom if ever reimbursed, and certainly never to the same extent, as if his capital, time, grass, and short feed, had been divided among animals of a smaller size. The object moreover, of all societies for improvement, should be rather to encourage persons to excel in their usual course of profitable pursuit, than to stimulate to over exertion, in the production of a single article, which does not admit of being introduced into general practice, or of setting an example that cannot be followed by the calling at large.

The foregoing remarks apply in the utmost latitude to sheep; and with respect to these, the society cannot with too much earnestness press their fellow farmers to abandon the practice of breeding from the common rams of the country, which are destitute of a single quality that entitles them to attention; but to resort to breeds which combine quality of wool with sweetness of flesh. For these qualities the *new Leicesters*, the production of the preseverance and genius of *Bakewell*, have been famous among other English breeds, for nearly half a century; and fortunately for this country, they partially exist in the utmost purity, and are also extensively diffused in various degrees of blood, throughout the states of Pennsylvania and New-Jersey.*

It has also been left for the spirited farmers in certain parts of those states to prove to what an extraordinary extent the same quality is possessed by the Tunis Broad-tailed, or Barbary sheep, the merits of which are particularly well known in the Philadelphia market.† The experience of the same states too, and of England likewise, has fully, repeatedly shown, that a cross of the

* Some of this breed have been occasionally brought to the cattle shows at Philadelphia, and have never failed to excite expressions of admiration in every beholder, by reason of their beauty.

† So well convinced are the butchers of the value of this breed, that they have been in the practice of purchasing rams, and of presenting them to farmers, merely to secure their produce to themselves, which they bought at generous prices. For an account of the Tunis Sheep, see the *Memoirs of the Agricultural Society of Philadelphia.*

merino with other breeds, not only effects an improvement in the wool, but also in the quality of the meat, and it is a fortunate circumstance that the unexpected multiplication of those precious animals by importation during the years 1810 and 1811, enables every farmer in the United States to possess himself of a ram of some merino blood and at a price little beyond that of common sheep, or of the use of a full bred merino ram, for a sum which cannot be an object with any one desirous of improving his flock.

In a country, the animal and vegetable produce of which is so infinitely beyond its internal consumption, and upon which the European world is obliged to depend for a steady supply for provisions to support their fleets, armies, and colonies, the improvement in the breed of *Swine* holds a rank in point of importance fully equal to that of horned cattle. For this reason, the society, when preparing their premiums, did not omit to call the attention of farmers to the subject; and they are pleased to notice that the superiority of a cross of the African or Guinea* breed of hogs, with the numerous varieties of other breeds, in the great requisites of early maturity and disposition to fatten easily, has occasioned that mixture to be extensively diffused throughout the states of Pennsylvania and New Jersey. The success that has attended the experiments of some of the members of the society with this breed, authorizes them to declare, that by due attention to the selection of well formed females, a degree of perfection may be obtained that renders all attempts at further improvement unnecessary.

The state of our political relations with England and France, for some years past, has prevented the exertion of that enterprise which the society were informed was about to be put in action on the publication of their premiums; and sufficient time has not since elapsed to prove what are the results of any steps that may have been taken to originate in our country, the breeds of cattle

* This breed, which is not to be confounded with that of *China*, is called commonly the "no bone breed," on account of the very small size of the bones.

possessing properties to which the society called the attention of the American cultivator; but they beg leave again to urge the attempt of producing them, from a conviction of the practicability of the measure arising from the existence of the necessary materials among us, the congeniality of climates, soils, and abundance of food in the United States; that the most ample remuneration will reward the expense of time, labour, and capital, and that the solid prosperity of the country will be promoted by the successful issue of the enterprise.

LAWRENCE SECKEL, *Pres't.*

April 16, 1812.

SEVENTH CATTLE SHOW.

THE seventh show, held under the direction of the Pennsylvania Society, for improving the breed of cattle, took place on Thursday, the 30th of April, and Friday, the 1st of May, at Bushhill.

The following cattle were exhibited:

1. By Mr. Shaffer, thirteen handsome and very fat cattle, and a very superior spayed black heifer, all from near Reading, in Berks county. They would have done credit to any country: the heifer brought to the recollection of some persons, the beautiful animal of the same description, exhibited by Mr. Dubs at the first cattle show in July 1810, and on inquiry it appeared that both came from the same farm.

2. By Mr. Shep, four steers, from three to five years old, and a spayed red heifer, all of excellent forms, capacious bodies, and in high order. Their weights of beef were estimated at from 800 to 1200 lbs. The great weight of such young cattle justly excited the attention of the grazing gentlemen present, being an approach to one of the great points that ought to be kept constantly in view in breeding cattle, viz. early maturity. These cattle were fed by Mr. Shep.

3. By Mr. M'Caskey, eight fat steers, two fine milk cows, and 35 sheep, from Lancaster county.

4. By Mr. J. Sill, 10 fat cattle, 1 cow and calf.

5. By Mr. Jacob Ridgway, a young bull calf nine months old, and well grown; the produce of a bull and cow imported from Holland. The sister of this calf, when two months old, was said to have sold for $35.

6. By Mr. Savin, from Kent county, Maryland, three fat oxen.

7. Mr. Barney, at the request of the society, brought a ram and three ewes of the new Leicester breed, being part of those he bought last autumn show. One of the ewes had a lamb six weeks old, for which 4 dollars 50 were offered by a butcher.

8. Mr. R. E. Smith, again showed two rams of the new Leicester breed, exhibited last autumn. Both those lots were admired by all who saw them; their bodies were completely enveloped in good long wool, and showed their naturally rotund forms to great advantage. Such animals cannot be too often seen in public, as they afford a lesson from which our farmers should profit. This lesson has been learnt by some of them, and the benefit derived from it has been amply felt.

9. Mr. James Caldwell brought 20 yearling merino rams and ewes, full blood, which served to keep up the reputation he has so deservedly acquired, as a breeder of this invaluable stock. Their fleeces entirely covered their bodies, and the quality and quantity of the wool, and the sizes of the animals bore the best testimony of the excellence of the stock, and of their *uniform good keep.* They were sold for cash at $45 per piece, to one gentleman, and destined for Ohio.

10. Mr. Bakewell, from near Norristown, brought several pigs, of the Berkshire English breed. The merits of this breed, in attaining great size, upon good keeping, (for which they are said to pay well) is well known in England. Mr. Bakewell has found a cross between this stock, and the African or *No-bone* breed, advantageous: the produce attaining speedily to desirable sizes, and taking on fat speedily.

11. Dr. Logan brought his fine Stud Horse Eclipse, whose sire and grand sire were also raised by him. Eclipse is now nine years old, a dappled brown, of excellent figure. His sire was Highflyer, from a full bred stock of mares of the true English Hunter breed, imported by the late Mr. Penn.

12. Mr. Dubs brought a fine Colt from the well known horse Hickory.

13. Dr. Logan brought a scarifier with five Shears, for pulverising ground, and cutting up surface weeds. It is made after the pattern of Mr. Cook, of England, and has been used with excellent effect during the last year.

14. Mr. Smith, of Bucks county, brought some of his excellent ploughs, which however were not tried, their merit being well known. Some of them were sold for 14 dollars.

The next Show will be held in the autumn, of which timely notice will be given.

ENGLISH PRIZE CATTLE.

[The following account of the Stock that gained the prizes at the Smithfield Show, is taken from the London Monthly Magazine of April 1812. It is addressed to the Editor of that miscellany by the secretary of the club.]

DEAR SIR,

THE Smithfield Club, instituted in the year 1798, for the purpose of ascertaining, by an annual exhibition, *what breed of oxen*, *sheep*, *and pigs*, *will improve the most in weight of meat*, *for the market*, *in a given time*, *and with a given consumption of food*, distributed their annual prizes in December last, on the award of Mr. Thomas Dalby, of Grubb-street, London, Mr. Robert Hughes, of Salthrop, Wiltshire, and Mr. Thomas Stone, of Barrow, Leicestershire, the three judges appointed for examining the many fine animals exhibited, and of weighing the se-

veral particulars in certificates of their breeds, ages, food, &c. Below is a return of the particulars:

PRIZE OXEN.

	Beef.	Loose fat.	Hide, &c.	Head.	Fat.
Mr. John Ellman, jun. 4 year old Sussex ox, worked 4 years, and fed on grass, hay, and 1001 lbs. of oil cake, . . .	1206	180	112	51	32
Mr. Henry King, jun. 3 year old Durham ox, fed on $7\frac{1}{2}$ hundred of hay, and 320 lbs. of oil cake, ...	1245	136	116	56	30
Mr. John Warmington's 4 year old Hereford ox, fed on grass, hay, and turnips, ...	1239	126	141	52	29
Mr. Michael Buckley's 3 year old Devon ox, fed on grass, hay, cabbages, and turnips, ...	842	107	76	21	18
His grace the Duke of Bedford's 4 year old West Highland ox, fed on grass, hay, and turnips, ...	538	74	56	$28\frac{1}{2}$	14
Mr. Robert Master's 4 year old Scotch ox, fed on grass, hay, and turnips, ...	$734\frac{1}{2}$	$90\frac{1}{2}$	64	$38\frac{1}{2}$	17

PRIZE SHEEP.

		Mutton and head. lb.	Loose fat. lb.	Skin. lb.	Live weight. lb.
Mr. Thomas Plasket's three 20 months old New Leicester wethers, fed on grass and cake,	1st.	119	11½	15	171
	2d.	116	10	15½	165
	3d.	124	12½	16½	181
Mr. James Parson's three 20 months old New Leicester wethers, fed on grass and turnips.	1st.	159½	16½	19	219
	2d.	149	15½	18	205
	3d.	137	12	16	189
Mr. John Boy's three 33 months old wether sheep, fed on hay and green vegetable food.	1st.	96	14	12	144
	2d.	105½	16	19	160
	3d.	116	19	14	168
Mr. John Warmington's three 19 months old Southdown wethers, fed on grass only.	1st.	92	15	12	135
	2d.	90	12	11	133
	3d.	87	10	13	128

PRIZE PIG.

Mr. William Hayward's 50 weeks old pig, fed on barley meal, mixed with the water from the spirit-grains from his brew-house:

Pork and head.	Loose fat.	Feet.	Live weight.
258 lb.	8 lb.	$3\frac{1}{2}$ lb.	304 lb.

(Signed) JOHN FAREY, Secretary.

Westminster, *Feb.* 14, 1812.

REMARKS.

Of the oxen, only the two first were fed on what may be called *extra feed*, viz. oil cakes, which are dear, and as in the case of stall feeding with Indian corn meal, take from the profit. The grass and hay, it may be supposed, were raised on the farm, and were no doubt consumed with advantage by the animals. The weights of all of them are certainly respectable, and they must have been very much disposed to take on fat and flesh, to die as they did. Two or three reflections which occur on this occasion, it is presumed will strike every intelligent American grazier. The Scotch ox, fed by the duke of Bedford, although small, may have proved as profitable as the larger animals, owing to the speed with which that breed fattens, and on that account, as stated upon a former occasion, it is much esteemed in England. The Scotch breed of oxen, (or Kyloes) would be a great acquisition in the United States, as they are extremely hardy, being raised in the inhospitable climate and on the scanty food of the Highlands of Scotland, and when removed to the rich pastures of the lowlands, or of England, thrive rapidly. This breed would bear well the cold in the breeding districts of our new settlements, and on good grass would be fat in July or August; a time when the stall-fed cattle are all killed, and the larger grass-fed beef is not yet fat.

The weights of the sheep deserve attention from the American farmer. It is by feeding such sheep that he would find his account. Indian corn not being required to fit them for market.*

IN order to judge of the comparative profit of feeding two breeds of sheep, the following statement of the weights of seven sheep of the Irish breed is given. They were raised and fed by Francis Hickman, of Chester county, Pennsylvania, and killed in March 1812, by Joseph Groffe, of Spring Garden.

	Skin.	Fat.	Meat.
	lbs.	lbs.	lbs.
1.	15	26½	115
2.	20	25	149
3.	16½	23½	133
4.	15½	34¼	139
5.	19	22	105
6.	15½	21½	120
7.	16	27	115

The precise cost of feeding the above sheep, cannot at present be ascertained. Indian corn, oats, and hay, were however given in abundance, besides pasture for two or three years. If the facts can be procured they shall be given hereafter.

On the stall they appeared covered with fat; so fat indeed, that it was difficult to find any flesh, and no greater proof could be required of the absurdity of a system of cramming, requisite to produce such over ripe animals. One leg weighed 19 lbs.!

* See Vol. 2d, p. 285, for weights of other New Leicester Sheep.

WEIGHTS OF MERINO FLEECES.

George-town, Kentucky, April 29, 1812.

ON Tuesday last, William Story, of George-town, sheared, of the flock belonging to Story and Nichols, 16 full-blooded Merino sheep; 10 of which were imported from Spain. The product was as follows:

	lb.	oz.
A ram, Judas, . . .	12	4
A ram, Don Carlos, . . .	9	12
An imported ewe, . . .	7	
Do. do. . . .	7	8
Do. do. . . .	7	8
Do. do. . . .	10	4
Do. do. . . .	8	4
Do. do. . . .	8	
Do. do. . . .	6	12
Do. do. . . .	6	4
A ewe lamb, Sancho, 15 months old, .	9	
A ram, Palafox, . . .	8	8
A ewe lamb, ...	7	8
A young ram, Columbus, 10 months old,	7	
A young ram, " " .	5	
A young ewe, about 10 months old, .	5	4
	125	12

Averaging the flock, including the lambs, about 7 lb. 14 oz.

The above shearing was attended by about one hundred persons.

It is not stated whether the above sheep had been washed previously to shearing. If they had not, some allowance must be made for loss in weight: even with that deduction, their weights were respectable.

Information received by the Editor from several gentlemen in Pennsylvania, New Jersey, and Delaware, enables him to state that Merinos yield 7½, 8, 8½, and 9 lbs. wool; the animals having been previously washed.

DIRECTIONS HOW TO MAKE HOUSE-LAMB.

THE business or art of making house-lamb, has been studiously kept secret, or known but to a few, in England, or elsewhere: hence we see no mention of it in any of their books of agriculture; and hence the ignorance in this particular, of both the gentleman and common farmer.

Those near London, who wish to have lambs *marketable* by Christmas, January, or February, are in the practice of art, to induce their ewes to take the ram, at an earlier season than nature dictates; this with us, is on the approach of our early frosts, so that our lambs fall, usually, from January to March, inclusive; and it is nearly the same in England. Hence grass lambs are seldom *marketable*, until May and June. This accounts why house-lamb commands at the London market, (and proportionally in Philadelphia) a guinea a quarter at Christmas; half a guinea, after the holidays; an English crown in February and March; and, on the appearance of grass-lambs in April, May, and June, the price is gradually reduced to half a crown.

To make, or fatten house-lamb for the market, let your ewes be well attended to, and fed upon a patch of rye, or rape, sowed early for the purpose; upon turnips or other corresponding food; affording abundant milk: as fast as your lambs fall, and can run well alone, all you have, are to be shut up together in a dark pen or stall, of proportionate size to the number of lambs you expect, having a narrow trough, breast high to them, to be daily supplied with Indian corn meal, with the bran in it; and hanging up, within their reach, one or more wisps or small bundles of fine hay for them to nibble at. This stall must communicate with, or adjoin, a larger apartment, into which you are to turn ewes twice or thrice a day, to suckle their lambs; and to sleep all night with them. Before turning the ewes out to pasture, each time, the lambs must be lifted into their small dark pen or stall, where they will have no room to skip or play their fat away:*

* A pen or stall, 6 or 8 feet square, is sufficiently large for thirty lambs or more.

here they will nibble so much of the fine hay, and eat so much of the dry Indian corn meal, from want of other employment, as to render themselves voraciously thirsty against the next meal of milk from their dams; which, with the other causes mentioned, makes them grow surprizingly large and fat in a short time. Lambs thus educated, will often promiscuously suck the ewes, without knowing or being attached to their own dams.—Hence a very great advantage: for when all grow large and strong, they become capable of consuming more milk than a single ewe can afford; and more especially those ewes which have two or more lambs each. For upon killing off all the lambs of a ewe, that ewe continues to give suck to the other lambs promiscuously as before, to the great advantage of the surviving lambs, now requiring additional nourishment. This is not the case when lambs run out at large with their dams.

As the intelligent practical farmer will readily see how advantageously he may adopt this management in rearing his *early* lambs, further directions will be useless: all who shall adopt it will unavoidably improve his breed of sheep, provided they sell off or kill their *late* instead of their *early* lambs, as is the general custom of farmers.

TO MAKE FAT AND WHITE VEAL.

THE calves, as soon as capable of running, should be shut up in a dark warm pen, or stall, in the manner directed for lambs; with a small manger, breast high, in which unsifted Indian corn meal should be given to them daily, in such quantities only as they will consume; with a small bundle of fine hay tied up, and a lump of chalk within their reach. The licking and eating of these, will create an increased appetite for the cow's milk, and contribute so much to fatten them as to make infinite difference in the growth and goodness of the veal; and their confined state will prevent their running their fat and flesh away. By licking the chalk, acidity, which often causes a loseness, is pre-

vented. A pen or stall eight or nine feet square, is sufficiently large for six or nine calves. The pen must be kept very dry and clean. By a strap round the neck, they should be led morning and evening to suck the cows, chained in their respective stalls, and then led back to their own. In this manner, calves may be taught to suck other cows than their dams; but this is seldom necessary where cows are properly fed, except where you wish to make an extraordinary sized calf, by keeping it a week or two longer than usual. The cows should be well fed upon good hay, and pumkins, and boiled or steamed potatoes, mashed and mixed with hay tea, to which a handful of ground linseed cake, or some flaxseed jelly, may be occasionally added. If the hay has not been salted when housed, or stacked, a handful of salt should be given twice a week. The hay tea is most profitably made, by collecting the blossoms and leaves of clover from the barn floor, barn entry, or from the horse troughs, and after putting them in a tub, by pouring boiling water on them. Cows are very fond of the water, and by sprinkling a handful of corn meal over the blossoms after they have drank it up, they will freely eat them.—To make veal white, bleed calves in the neck every third day, in clear weather, during the third and fourth week, until the calf is nearly faint, which may be known by its eyes. These bleedings should be in the middle of the day, after the calf has nearly digested its morning's meal. No animal is more subject to a plethora, or too much fullness, than calves; they therefore bear bleeding well. On this account also, they should be moderately fed at first, and blood must be taken away whenever they loathe their food.

PROFITABLE COW.

[The following account of the produce of the third and fourth years of the cow mentioned in vol. 2d, p. 399, is taken from a recent British agricultural publication.*]

THE cow calved April 6th, 1807, and the calf was sold at fourteen days old. From that time to the 4th of February 1808, the produce was,

Butter 675lbs. and sold for - -	£.	49	9	2
The milk produced was 5782 quarts, of which 5107 quarts sold at 1*d.* skimmed,		21	5	7
The calf at 14 days old, - - - -		2	12	6
The manure, - - - - -		3	0	0
Total produce,	£.	76	7	3
Deduct expenses,		24	14	2
Neat profit, -	£.	51	13	1

The fourth year, 1808, she calved on the 23d April, and up to the 13th February 1809, she gave as follows:

Butter 466lbs. and sold for - -	£	34	5	0
Milk produced was 4219 quarts, of which 3753 was sold at 1*d.* for - - -		15	12	9
The calf at 17 days old, - - -		1	16	0
The manure, - - - - -		3	0	0
Total produce,	£.	54	13	9
Deduct expenses,		24	14	2
Neat profit,	£.	29	19	7

* Agriculture defended by Philarator, p. 71, London, 1811. The statement is taken from the Commun. to Board of Agriculture of London.

The neat profit of this valuable cow in five years was as follows:

1st year, - - -	£. 42	15	1
2d year, - - - -	30	16	1
3d year, - - - -	51	13	1
4th year, - - - -	29	19	7
5th year, - - - -	59	17	0
	£. 215	0	10

No one will deny that this profit is very great, and the above statement proves incontestibly, that a good milch cow pays a great interest for the extra food allowed her.

The following account on the profit of the dairy is taken from the work last quoted.

"There lives in Somersetshire, a widow, who rents fifteen acres of good meadow, at £.4 per acre; on which she keeps ten cows. She has no other concern, yet she sells annually from these ten cows, to one dealer in Bristol, regularly 6000 lbs. of cheese: and avows that her average income from her little dairy is £270, and she accordingly pays income tax on that sum.

Statements of the Dr. and Cr. of American dairies would be acceptable.

PAPERS ON THE USEFUL ARTS.

OBSERVATIONS ON THE PRESENT STYLE OF AMERICAN ARCHITECTURE, WITH A PLAN FOR IMPROVEMENT.

IN a conversation with Mr. Fulton on this subject, he dwelt on the irregularity of the style of building houses in cities in the United States, and the superiority of the colonnade principle, and offered the annexed plan of a row of houses, to illustrate his objections, and intended substitute. In a letter accompanying the draught he observes,

" As to our mode of building, there is much room for improvement. Our ancestors built such houses and streets as they were accustomed to see in Europe a century ago; and our masons and carpenters by habit continue the imitation. Hence we have, even sometimes within one hundred yards of length, in the same street, high steps, low steps, no steps, porches, no porches, cellar doors of 30, 40, and some 50 degrees elevation: and hence in the first place irregularity, confusion, nooks and corners for dirt. The width of the pavement is diminished, and the clean and uniform lines which give a grandeur to architecture, are destroyed. Added to these evils, no thought has been given to shelter us from the snow, and cold rains of winter, or the burning sun, and violent rains of summer.

" I here give you a sketch of two streets, each 35 feet wide, from front to front of the houses. (See the plate.) AA, is our present mode of building steps, occupying half of a narrow pavement, and offices X half under ground; a person on a bad pavement exposed to a burning sun, BCC, rain or snow. D shows a street of the same width, with the proposed improvement, viz. by placing the pavement under the building, and supporting the fronts of the houses by a colonnade or arcade. This much taken out of the under part of the front of a house, could, if required, be given in depth under a piazza projecting into the yard. Thus foot passengers would be under cover, offices above

ground, and cellars under offices; cellar doors as at EE, near the curbstone, the line of pavement straight and neat, and easily kept clean. This would not only be a very convenient mode to widen narrow streets by degrees, as buildings are pulled down and rebuilt, but where streets are wide the fronts might come over the pavement. In considering this mode of building, I am convinced you will see all the numerous elegancies and conveniencies which would result from it. It is moreover as cheap as the common mode of building; the steps and rails costing at present as much as the columns."*

At Chester, in England, it is said† the foot passengers walk through the fronts of the first floors of all the houses, under colonnades, with shops on the one hand, and pleasant balconies on the other, and it is remarked that nothing can be more commodious, pleasant, sociable, and picturesque; a delightful walk is afforded by the arrangement in all weather, trade is rendered subservient to luxury in the preservation of the spacious walls of the houses, and luxury repays trade for the accommodation, by the rows, or by what in Covent Garden would be called the Piazzas, or at Tunbridge the Pantiles.

In the city of Bologna, in Italy, in all the principal streets, and many of the lesser ones, the colonnade principle is adopted.

The idea of a colonnade, suggested by Mr. Fulton, was projected several years ago by Mr. Mills, architect, now of Philadelphia, when engaged in the design for the Scots Church in Charleston, S. C., but was not carried into effect. The propriety of a covered walk round the building occurred to him, without having any previous knowledge of its being introduced elsewhere. In a climate like that of S. Carolina, the advantages of such a walk would be sensibly felt, and there is scarcely any building whether public or private, but would afford more or less

* A very neat model in mahogany of a row of houses upon the above plan, was sent by Mr. Fulton to the Editor, who has deposited it in the *Academy of Fine Arts*, Philadelphia.

† Monthly Mag. London, April, 1812.

comfort from the possession of it. Besides providing for such a walk, the arcade intended to constitute it, by forming the support of the galleries, would have freed the nave of the church from interruption of columns (necessary to the support of galleries in the usual way) thereby producing a finer relief to the room; and the walls below being sheltered from the sun's rays by the projection of the galleries externally, would have prevented the accumulation of heat.

The architecture of the United States is certainly improving: one mark of a disposition to improve in any branch is a change from former habits, and in Philadelphia, at least, this is perceptible to all within a few years, in the buildings.

The style of building (called the Basement plan) which places the offices upon the first floor, has been successfully introduced in Philadelphia, in several instances by Mr. Mills. The two first houses executed upon this plan, are on Chesnut street, at the South West corner of seventh street. The westernmost exhibits the best specimen, as it has more front. The entrances are sheltered by circular porticoes. The next instance of the basement plan is in Washington Square, Locust street front, between ninth and tenth streets, in four houses, twenty-eight feet front each. These recede from the line of the street eighteen or twenty feet, which space is to be inclosed by a palisade fence, and laid out in grass and shrubbery. A colonnade will extend the whole front of the building, which, whilst it affords below a shelter to the inhabitants from the rain and sunbeams, provides a balcony above for the display of shrubbery, and affords a promenade during the shady hours. It may be observed, while speaking of these buildings, that much credit attaches to the proprietors* of the square on which they are built, for the judicious arrangements and spirited improvements they have and are making on this square, which promises to be the handsomest in Philadelphia.

* Messrs. Meany and Savage, merchants.

As connected with this subject, the following remarks on the CONSTRUCTION OF CITIES deserve serious attention in the United States. The ideas, and the facts on which they are founded, are perfectly correct, and it is to be much regretted, that an attention to wealth, instead of the public health, should operate to prevent the general adoption of the plan suggested.

Extract of a letter from Thomas Jefferson, to William C. C. Claiborne, governor of Orleans territory, dated Washington, July 7th, 1804.

" The position of New Orleans certainly destines it to be the greatest city the world has ever seen. There is no spot on the globe to which the produce of so great an extent of fertile country must necessarily come : it is three times greater than that on the eastern side of the Alleghany, which is to be divided among all the sea-port towns of the Atlantic states. There is also no spot where yellow fever is so much to be apprehended. In the middle and northern parts of Europe, where the sun rarely shines, they can safely build cities in solid blocks without generating disease. But under the cloudless skies of America, where there is so constant an accumulation of heat, men cannot be piled upon one another with impunity. Accordingly we find this disease confined to the solid built parts of our towns, and the parts on the water side, where there is much matter for putrefaction, rarely extending into the thin parts of the town, and never into the country. In these latter places it cannot be communicated ; in order to catch it you must go into the local atmosphere where it prevails. Is not this then a strong indication that we ought not to contend with the laws of nature, but should decide at once that all our cities shall be thin built ? You will perhaps remember, that in 1793, yourself, the present governor Harrison, and some other young gentlemen, dining with me in Philadelphia, the then late yellow fever being the subject of conversation, and its incommunicability in the country, I observed that in building cities in the U. States we should take the chequer board for our plan, leaving the white squares open and unbuilt for ever, and

planted with trees. Harrison treasured this idea in his mind, and having to lay off a city two or three years ago on the banks of the Ohio, he laid it off on this plan. As it is probable New Orleans must be very soon enlarged, I enclose the same plan for consideration. I have great confidence that howsoever the yellow fever may prevail in the old part of the town, it would not be communicable in that part which should be built on this plan; because this would be all like the thin built parts of our towns, where experience has taught us, that a person may carry it after catching it in its local region, but can never communicate it out of that. Having very sincerely at heart that the prosperity of New Orleans should be unchecked, and great faith, founded as I think in experience, of the effect of this mode of building against a disease which is such a scourge to our close built cities, I could not deny myself the communication of the plan, leaving it to you to bring it into real existence, if those more interested should think as favourably of it as I do. For beauty, pleasure, and convenience, it will certainly be eminent."

PROCESS FOR PROVING THE QUALITY OF A GLAZE OF EARTHENWARE.*

THE glaze of earthenware may have several defects: it may be scratched more or less readily by a hard body; weak acids, such as vinegar, lime-juice, verjuice, &c. may attack and dissolve the lead it contains, or oily substances standing long on it may produce the same effect, stain it and render it dull.

To determine its power of resisting friction, it may be rubbed with sand, and if this scratch it more readily than it does a glaze known to be good, we may be assured it is soft.

If vinegar be boiled for some hours in a vessel coated with a soft glaze, it will attack the glaze, and dissolve a portion of its

* Sonnini's Bibliothèque Phisico—Economique, July 1807, p. 43.

lead, which will be precipitated from the vinegar on the addition of a few drops of sulphuric acid, commonly called oil of vitrol.

But a method more within every one's reach, therefore deserving to be known, is, to let fall a drop of strong ink on a piece of earthenware, dry it before the fire, and then wash it: if the glaze be too soft, the ink will leave on it a slight spot.

A full description of the method of preparing Mr. George Blackman's superfine oil-colour cakes; as communicated to the Society for the encouragement of Arts, Manufactures, and Commerce, London, and practised by him in presence of a committee appointed by the society to ascertain the merit of the invention.*

TAKE of the clearest gum mastic, reduced to fine powder, four ounces; of spirit of turpentine, one pint; mix them together in a bottle, stirring them frequently till the mastic is dissolved: if it is wanted in haste, some heat may be applied; but the solution is best when made cold. Let the colours to be made use of be the best that can be procured, taking care that by washing, &c., they are brought to the greatest degree of fineness possible. When the colours are dry, grind them on a hard close stone (porphyry is the best) in spirit of turpentine, adding a small quantity of the mastic varnish: let the colours so ground become again dry; then prepare the composition for forming them into cakes in the following manner:—Procure some of the purest and whitest spermaceti you can obtain; melt it over a gentle fire, in a clean earthen vessel; when fluid, add to it one-third of its weight of pure poppy oil, and stir the whole well together: these things being in readiness, place the stone on which your colours were ground on a frame or support, and, by means of a charcoal fire under it, make the stone warm; next grind your colour fine with a muller; then, adding a sufficient quantity of the mixture

* From the twelfth volume of the Transactions of the Society, who voted the greater silver palette and twenty guineas to Mr. Blackman, for discovering his process for the use of the public.

of poppy oil and spermaceti, work the whole together with the muller to a proper consistence; take then, a piece of a fit size for the cake you intend to make, roll it into a ball, put it into a mould, press it, and it will be complete.

When these cakes are to be used, they must be rubbed down in poppy or other oil, or in a mixture of spirit of turpentine and oil, as may best suit the convenience or intention of the artist.

The abovementioned oil-colour cakes were tried after they had been in the possession of Mr. Cosway and of the Society for twelve months, and were found to possess the same valuable properties they had at first.

Mr. Cosway says, that he made several experiments with these colours, and is of opinion that the manner in which they are composed is a new and useful discovery; and the great advantage they possess of drying without a skin on the surface, is a a very essential improvement on the usual mode of oil-painting, particularly for small works.

Mr. Stothard says, one advantage these colours possess above others is, they must be very convenient to travellers, as they are always fit for immediate use, they not drying hard nor skinning over.

Mr. Abbot says he has frequently used colours prepared by Mr. Blackman, particularly his red lead, which, as far as he can judge, is better preserved from changing by this method of preparing, than by any other he has met with; and as the tint given by red lead is peculiarly adapted to the highest lights of flesh, more especially on the forehead in portrait-painting, he thinks Mr. Blackman's discovery, if it fully answers that purpose, a very advantageous one to artists; that he has so good an opinion of Mr. Blackman's ingenuity and merit on this head, that he has ordered a set of colours prepared in his manner, in bladders, for his own use.

N. B. It may here be proper to observe, that Mr. Blackman's colours in bladders are prepared with a mixture of spermaceti, and differ from his cakes only in having a larger proportion of oil.

TO FIX CHALKS ON BROWN OR COLOURED PAPER.

In reply to a query on this subject in the London Monthly Magazine, the following method is given, in the same Magazine for April, 1812.

DIP the drawing into a vessel of cold water, large enough to admit it with ease; and then put it under the roller of a mangle, with a sheet of paper over it, and turn the mangle with no more than sufficient force to smooth it: this will at once communicate a very faint impression of the drawing to the blank paper, and fix the chalks for ever after.

ON THE MANUFACTURE OF SALT PETRE.*

AMONG the numerous and diversified blessings which Providence has conferred upon the United States, calculated to render them independent of the whole world, the abundance of nitre in coals, and in the soil of Kentucky, Tennesee and Virginia, is of the first importance at this time, when the injustice of foreign governments has forced us to assume a warlike attitude, and the energies of the nation are about to be called forth: and as it is believed that the process adopted in the refining it is far from perfect, the following account of the salt, and of the improved mode adopted in France to prepare it, will, it is hoped, be attended with the wished-for utility.

EDITOR.

SALT PETRE, NITRE, or chemically speaking, NITRATE of POTASH, is a neutral salt composed of nitric acid and potash in a state of mutual saturation. Its primitive crystalline form is that of a rectangular octohedron, composed of two pyramids, applied base to base, in such a manner that two opposite sides of the upper pyramid form with the corresponding sides of the lower one angles of 120°, while the two other opposite sides form with the corresponding ones angles of 111°. This figure how-

* From Aitkin's Chemical Dictionary.

ever is of very rare occurrence. When the summits of the pyramids are deeply truncated, the result is a bevelled rectangular table, which is by no means unfrequent. But the most usual form which this salt assumes, is that of the common quarts crystal, viz. a straight six-sided prism, terminated at each extremity by a six-sided pyramid.

Nitre may be considered both as a natural and artificial product. Native nitre, mineralogically speaking, is a substance of very recent formation. It appears to occur in two different repositories: the first of these is limestone, and the second is vegetable soil. The calcareous repository is either a peculiar variety of secondary floetz-limestone, or calcareous tufa, or chalk, or indurated marle. In these rocks it occurs as a thin granular crust, or an efflorescence of minute spicular crystals over-spreading the outside, and particularly lining the inside of the caverns both natural and artificial, with which these rocks abound. Hence probably is derived its ancient name, saltpetre, (*Sal Petræ*, Rock Salt.) Calcareous strata containing nitre, are found in various countries.

In many nitrous soils the acid which they contain is combined for the most part with lime instead of potash, so that the produce of real potash, which they afford by the usual mode of treatment is very small. Long experience, however, has taught the nitre-makers in every country where these soils occur, to remedy this defect by the addition of wood ashes; the rationale of which is as follow: The carbonated alkali of the ashes and the calcareous nitrate of the soil mutually decompose each other, and carbonated lime and nitrated potash is the result. The soil being dug up is mixed with about one-fifth by measure of wood ashes, and lixiviated in perforated casks in the usual way: the liquor thus produced, when concentrated by repeated lixiviations, is mixed with the mother water of a preceding crystallization, and boiled down for 24 hours, removing from time to time the common salt and muriated potash that separated during the process: it is now transferred while hot into shallow coolers, in order to crystallize, which it does in 24 hours more. The rough

crystals being drained, are again dissolved in water, and the product of the second crystallization is a nitre somewhat impure, but yet in a fit state for the market. Four hundred cubic feet of the mixture of earth and wood ashes afford 42 lbs. of nitre of the first crystallization, which, by the subsequent refining, is reduced to 39 lbs.

At the commencement of the French revolution, the demand for saltpētre in the gunpowder manufactory was prodigious, while all the requisite nitre was obliged to be drawn from domestic supplies. To meet this exigency, the knowledge and personal superintendance of the ablest chemists of Paris was directed to this important object; and in the space of a very few years the produce of nitre was more than quadrupled, and a simplicity and expedition introduced into the refineries of this salt, that seem to have brought its manufacture nearly to perfection.

It remains to give an account of the extraction of nitre from the earths in which it is contained, and of the purification of this salt.

The first thing to be done is to assay the earth. This is done by lixiviating a few pounds of it, and adding to the liquor thus obtained as much of a solution of common potash of a known strength, as is sufficient to decompose all the earthy salts. From this assay, the quantity of alkali required is easily calculated.

The next process is lixiviation, which is performed in the following manner: Several cart loads of nitrous earth are mixed as accurately as possible with the requisite quantity of alkali, either in the form of wood ashes or pulverized potash. Several large casks with perforated false bottoms are then filled with the prepared earth laid on it lightly; after which, as much river water is poured in as the vessel will hold. In two or three hours the cock at the bottom of each cask is turned, and the liquor is allowed to drain out during the remainder of the day. The casks of a second series charged with earth as before, are now filled up with the first lixivium, and after standing for a few hours, the liquor thus concentrated is drawn off in the manner just described. By a similar process on the third day, a lixivium

thrice as strong as the first is obtained, which is now sufficiently concentrated to be boiled down. The contents of each series of casks are lixiviated twice more, and the weak solutions thus obtained are employed instead of water in the first and second lixiviums of fresh parcels of earth.

The boiling down and evaporation next succeed. The lixivium, containing nitrate of potash, the muriates of potash and soda, with probably a few other salts, and various earthy impurities, is put into a large boiler like a salt-pan, and heated nearly to ebullition: it is then clarified by the addition of bullock's blood, or a solution of glue, the impurities as they appear on the surface being carefully skimmed off: when no more froth rises of itself a little lime-water is added, which coagulates the remainder of the blood and glue, and thus completes the clarification. It is now boiled for several hours, and the muriates of potash and soda as they deposit are withdrawn by a perforated ladle. When the liquor is so concentrated that a few drops crystallize readily on being dropped on a cold iron, it is laded out into a vat, where it remains half an hour to deposit the common salt and impurities still floating in it; hence it is transferred to large wooden or metallic crystallizing basons, where it remains close covered up during from three to six days, according to the temperature of the air. At the expiration of this period, the mother water is poured out and returned to the nitre bed, and the salt deposited in a confused crystalline mass of an opaque dirty white, is broken to pieces and set to drain, after which it is brought to market, or delivered into the government stores, as rough nitre or nitre of the first boiling.

To refine rough nitre according to the new and improved French method:

The rough nitre is broken to small fragments by wooden mallets, and is then put into a wooden tub with twenty per cent. by weight of cold water; in this state it remains for six or seven hours, being occasionally well stirred up, that the water may have free access to every part. The water is now let out by a hole at the bottom of the vessel, and carries with it in solution

all the deliquescent salts, and the greatest part of the muriates of soda and potash, together with some nitre. When the whole of the liquor is drained off, ten *per cent.* more of water is added, and well mixed with the nitre for an hour's time, when it is discharged in the same manner as the first. Lastly, five *per cent.* of water is poured in, and run off again almost immediately after. The petre thus washed, after being well drained, is put into a boiler with half its weight of water, and boiled till a pellicle forms on its surface; the liquor is then discharged into a large leaden cooler, and stirred about with rakes, till it is quite cold, by which manipulation the salt is deposited in small crystalline needles. It is now taken out of the liquor with a perforated ladle, and well drained; after which it is washed with five per cent. of cold water, and again drained: being then spread out on a large table, it dries in a few hours, and is lastly heated over the fire in large basons for two or three hours, at a temperature not exceeding 120° Fahr., taking care to stir it all the while; by this treatment it is perfectly purified and brought to the consistence of fine sand, and is now ready to be manufactured into gunpowder.

TO FIND THE SPECIFIC GRAVITY OF ANY FLUID, BY MEANS OF A SMALL VIAL AND A PAIR OF SCALES.

Communicated by Robert Patterson, Professor of Natural Philosophy and Mathematics, in the University of Pennsylvania.

METHOD FIRST.

HAVING provided a small glass vial, with a ground glass stopper, and a pair of small accurate scales, such as a pair of money-scales—

1. Weigh the glass vial with its stopper, while clean and dry, in the open air, and mark the weight.

2. Fill the vial with rain or distilled water, reduced to any standard-temperature, say 60° Far., and put in the stopper under water, so as effectually to exclude any air-bubble that might otherwise lodge between the water and the stopper.

3. Wipe the outside of the vial dry, and find the weight of the whole, from which subtracting the weight of the empty vial, there will remain the neat weight of the water. This being found, the process need never again be repeated.

4. Pour out the water, and having with a little cotton, or the like, carefully dried the vial, fill it with the fluid of which you wish to find the specific gravity, and using the same precautions as before, find the weight of the vial with its contents, from which subtracting the weight of the vial before found, there will remain the neat weight of the given fluid.

5. Divide the weight of the given fluid by that of the standard water, found as above, and the quotient will be the specific gravity,—that of water being unity.

METHOD SECOND.

1. Provide, as before, a small glass vial, with a ground glass stopper, and put into it as much mercury, shot, or sand, as will be sufficient to sink it in water, or in any other fluid on which you may make experiments.

2. The glass stopper being carefully put in, and the outside of the vial wiped dry, weigh it both in the open air, and in standard-water: which process need never again be repeated.

3. Weigh this vial with its ballast in the fluid, whose specific gravity you would find.

4. From the weight of the vial in air, subtract its weight in water for a divisor; and from the same weight of the vial in air, subtract its weight in the given fluid, for a dividend; then the quotient of this division, will be the specific gravity required.

☞ In order to weigh the vial in water, or any other fluid, you may pass a horse-hair through a small perforation made in the bottom of one of the scales, and fastening it round the neck of the vial, you may then weigh it suspended in a tumbler of the given fluid.

The first of the above methods of finding the specific gravity of a fluid, is, perhaps, generally to be preferred. R. P.

ACCOUNT OF MR. LESLIE'S EXPERIMENTS IN FREEZIEG WATER AND MERCURY, UNDER AN EXHAUSTED RECEIVER.

Communicated by a friend to the Editor.

PROFESSOR Leslie, of Edinburgh, having in the course of a train of experiments on the relation of air and moisture, found that the cold produced by the evaporation of water, depends merely on the dryness of the air independently of any other circumstance, that air is rendered much drier by rarefaction, and having also remarked the strong and durable power of sulphuric acid in attracting water from the air, he determined to try the combined operation of these powers in the freezing of water. Sulphuric acid, in a saucer, was accordingly placed on the plate of the air pump, and about two inches above it a narrower dish of water, and a double case of tin below: he then exhausted the receiver, and so violent was the cold produced from the rapid evaporation, that the congelation began in about a quarter of an hour. Nothing can exceed the beauty of the spiculæ of ice shooting over the surface. After the freezing is over, the ice never returns again under the receiver to the form of water, but remains as ice, till the whole, after some days, has disappeared. All this time, the acid is warmer in proportion to the coldness of the ice, and yet the power of the acid was not sensibly diminished, until after a considerable time. Cakes of ice, six inches broad and three-fourths of an inch thick, were frozen in July; and by enlarging the apparatus, the effects would be much greater.

The following account of the application of Mr. Leslie's process, is given in Tilloch's Philosophical Magazine (London) for March, 1812.

The experiments of professor Leslie to produce ice by evaporation in the air-pump, have been varied and extended in France by Messrs. Clement and Desormes: they have proposed to apply the evaporation, in vacuo, on a large scale, to the drying of gunpowder; which, being done without fire, will be attended with no danger.

The French chemists are engaged in endeavouring to apply

the evaporation in vacuo also to the drying and preserving fruit and vegetables. It may be easily conceived of what advantage this process may be, particularly in the army and navy, by preserving unchanged, alimentary substances, and also by diminishing their weight and bulk, when they are to be sent to distant parts of the world.

Mr. Leslie proposes to introduce the apparatus into hospitals in sultry climates, and to various domestic purposes; among others, to coolers, so as to produce ice in large quantities.

From Tilloch's Philosophical Magazine, for April 1812.

Professor Leslie has succeeded in freezing quicksilver by his frigorific process. This remarkable experiment was performed in the shop of Mr. Adie, optician, with an air-pump of a new and improved construction. A wide thermometer tube, with a large bulb, was filled with mercury, and attached to a rod passing through a collar of leather, from the top of a cylindrical receiver. This receiver, which was seven inches wide, covered a deep flat bason of nearly the same width, and containing sulphuric acid, in the midst of which was placed an egg-cup half full of water. The inclosed air being reduced by the working of the pump to the 50th part, the bulb was repeatedly dipt in the water, and again exposed to evaporation, till it became incrusted with a coat of ice about the 20th of an inch thick. The cup, with its water still unfrozen, was then removed, and the apparatus replaced, the coated bulb being pushed down to less than an inch from the surface of the sulphuric acid. On exhausting the receiver again, and continuing the operation, the icy crust at length started into divided fissures, owing probably to its being more contracted by the intense cold, than the glass which it invested; and the mercury having gradually descended in the thermometer, till it reached the point of coagelation, suddenly sunk almost into the bulb, the gage standing at the 20th of an inch, and the included air being thus rarified about 600 times. After a few minutes, the apparatus being removed, and the bulb broken, the quicksilver appeared a solid mass, which bore the

stroke of a hammer. The temperature of the apartment was then 54° of Fahrenheit.

In another experiment, with a small spirit of wine thermometer, under the same circumstances, and the same degree of rarefaction, the cold produced was found to be 70½° below nothing, or more than 30° below the point usually assigned for the congelation of mercury.

Such a prodigious power of refrigeration, and which will no doubt be further improved, opens a wide field for philosophical investigation. Liquids which have hitherto resisted coagelation may yet be rendered solid, and gases converted into liquids.

From the following extract, it will appear, that in the application of the principle of Mr. Leslie, by the French, they have long since been anticipated. It is taken from page 8 of the Appendix to the "*Mill-wright and Miller's Guide*," by Oliver Evans, published in Philadelphia in 1795, containing "Rules for discovering new improvements."

"EXAMPLE EIGHTH.

"Take the art of preserving fruits, liquors, &c. from putrefaction and fermentation. Step 1. What are the principles of putrefaction and fermentation? By experiments with the air-pump, it has been discovered that apples, cherries, &c. put in a tight vessel, having the air pumped out, will keep their natural fresh bloom for a long time. Again, by repeated experiments, it is proved, that things frozen will neither putrefy nor ferment while in that state. Hence he may conclude that air and heat are the principles or moving causes of putrefactive fermentation.

II. What plans in theory are most likely to succeed? By removing the causes we may expect to avoid the effect.

1. Suppose a cistern in a cellar on the side of a hill, and supplied by a spring of cold water running in at the top, that can be drawn off at the bottom at pleasure. If apples, &c. be put in tight vessels, and the air pumped out, and beer, cyder, &c. be put in this cistern, and immersed in water, will they putrefy or

ferment? May not the experiment succeed in an ice-house, and fruits be conveyed from one country to another in glass or metal vessels made for the purpose, with the air pumped out and hermetically sealed? In support of this hypothesis, a neighbour told me, he filled a rum-hogshead in the autumn with apples, at the bung; bunged it tight, and in the spring found them all sound. Another: when a boy, I buried a hollow gum bee-hive full of apples, trampled the earth tight about them, opened them when the wheat began to ripen, and found them all sound; but leaving them, I returned in a day or two, and found them all rotten.

STEAM BOAT CONTROVERSY.

THE question on appeal, between Messrs. Livingston and Fulton, and a combination at Albany relative to the exclusive right of the appellants to run steam boats on the waters that were within the jurisdiction, and were the property of the state of New York, having been determined in favour of the appellants by the unanimous vote of the court of appeals in that state; a short account of the controversy may be interesting to those who wish to encourage talents and enterprize. It is communicated by an eminent legal character, in New York, at the request of the Editor.

By the laws of the state of New York, a contract was entered into by that state, with Robert R. Livingston, Esq. for the building of steam boats. The laws recited that the state, in consideration of the advantages that would result to it from this enterprize, if successful, and the expense, and hazard, with which the experiments would be attended, grant to the said Robert R. Livingston, Esq. the exclusive right to navigate the waters of the state for twenty years with boats moved by steam or fire, upon condition that the said Robert should build a boat that should not be less than twenty tons burden, that should go four miles an hour; and should keep such boat in constant operation on Hudson's river. Mr. Livingston in pursuance of the law

built in the year 1800, a boat; but from the small size and imperfection of the engine he used, and perhaps from a defect in his plan (which was a horizontal wheel receiving the water at its centre, and propelling it by the centrifugal force from the stern) the boat went but little more than three miles an hour. As this was not a compliance with his contract, he founded no claim upon it: but broke up his boat and sold the engine, sustaining a loss of about $ 8000. Being shortly after sent as minister plenipotentiary to France, he, in conjunction with Mr. Fulton, whom he met at Paris, tried a variety of experiments on the different modes of propelling a boat by steam, and was convinced by them of the expediency of preferring that suggested by Mr. Fulton, and was in use in the state of New York. That nothing might be wanting to reduce their principles to practice, they built a large boat on the Seine, upon which they expended $ 8000, beyond what the materials sold for when taken to pieces. Encouraged by this experiment, they obtained from the state of New York, a law renewing their former contract, and extending it to Robert R. Livingston and Robert Fulton. In pursuance of this encouragement, they built three large vessels, the united tonnage of which amounted to upwards of 800 tons, (besides others built under their patent, and upon their models)and finished, furnished, and navigated them in such a style of expense and elegance, as renders the mode of travelling in them unequalled by any that Europe can boast of. We have been credibly informed, that they have expended on those boats and on one on the Ohio, and previous experiments, upwards of $ 150,000. Three years after these, or some of them were in operation, when every difficulty was removed and they began to reap some remuneration for their bold and expensive enterprize, a number of wealthy persons in Albany, (about 24) by no means distinguished for mechanical talents, combined to make two boats upon the model of the patentees, with very trifling variations to colour their usurpation, and actually built such boats, and run them the last summer (1811) in competition with the boats of Messrs. Livingston & Fulton. These gentlemen brought suits against the intruders,

and applied to the court of chancery for injunction to stop their boats; this the chancellor refused to grant. From the chancellor's decree, they appealed to the court for the trial of impeachments and the correction of errors; which is the highest court of judicature in the state of New York; and is composed, in case of appeals, of the five judges of the supreme court, and members of the senate, many of whom are always professional lawyers.

The ground taken by the defendants was, 1st, that congress having a right to grant patents, the state had no right to make any contract which might interfere with that right.

2d. That congress having a right to regulate trade, the waters of the state were subject to their control, and no exclusive privilege would be granted upon them.

3d. That an injunction should not issue till the right was tried at law.

The appellants insisted, first, That congress had no power but to *secure* to inventors the right to *their* invention. That the right must therefore be such as could and did exist before it was secured. That no right ever existed or could exist in inventors to control that of a state to prohibit the use of an invention that they might find injurious, or to encourage enterprize by exclusive privileges. That these powers were of the essence of every independent government; and as congress could not give exclusive privileges, the right to give them must rest in the state. That the most dangerous consequences would result from a contrary doctrine.—It was asked, cannot the legislature of Carolina prohibit the sale of a book upon the right of slaves to recover their liberty by force, or could they not give an exclusive right to one who imported, though he was not the inventor of a useful machine? and that as no power exists in congress to do these acts, such power must reside in the state. It was alleged that every power vested in congress not in its nature exclusive, or prohibited to the states, might be exercised by them in concurrence with congress. That the *securing* a natural right, had nothing exclusive in its nature, and might therefore be increased

by any state within their jurisdiction. That the whole power of congress went to prevent one man from using the mental property of another; but not to change the nature of that property, which, like all other, must be held subject to the laws of the state. That in New York, the right to navigate by steam, having been vested in Mr. Livingston, previously to any patent for such object, no natural right could exist in any inventor to exercise his invention within that state, if it interfered with Mr. Livingston's right. That the defendant had not even a patent, but merely copied the boats of the appellants, without setting up a claim to invention.

As to the second head, they showed, that though congress might have a right to regulate trade between foreign nations and different states, the constitution gave them no right to interfere in the internal concerns of the states. That turnpike roads, toll-bridges, ferries, stages, &c. were all granted by every state in the union. That the state had even a right to regulate, and actually did regulate trade every day, even with foreign nations, and the respective states; their power in that, being concurrent with congress, except so far as that they could not regulate by treaties, or the imposition of duties. That there was not a word in the constitution that gave congress a jurisdiction over the waters of a state. That on the contrary, congress had themselves, by a variety of laws, recognised the absolute jurisdiction of the states, and even their right, by their quarantine laws, to prohibit the entry of foreign vessels into any of their ports. That the mere apprehension, that the exercise of a power by a state might interfere with a right of congress, can be no objection to it, because when it actually interferes it must give way, but not till then. As to the third point, they showed that it was the invariable practice of the courts in England, to grant injunction wherever a right was founded, like that of the appellants, upon act of parliament, and that there was not a *single* case to be found in contradiction to this rule. That the defendants were likewise entitled to an injunction on the ground of their having been in quiet possession for some years.

The cause was very ably argued on both sides for five days, when, after taking time to consider, the judges gave their opinion in writing, on all the points, in very luminous arguments, in which some of them noticed with great force, the injustice of the attempts of the defendants to avail themselves of the hazard and enterprise of the appellants, and the effect that such conduct might have on the morals of the people, if it did not meet with the indignant frowns of the court.

The other members of the court concurred unanimously with the Judges in reversing the Chancellor's order, and confirming the right of the appellants to navigate the waters of the state by steam or fire exclusively, directing the Chancellor to issue an injunction to continue it till the final hearing of the cause, and then, unless new matter appears, to render it perpetual during the continuance of their exclusive privileges.

A LIST OF THE NAMES OF PERSONS TO WHOM PATENTS HAVE BEEN ISSUED FROM THE TWENTY-EIGHTH OF DECEMBER, 1810, TO THE FIRST OF JANUARY, 1812.*

THE ingenious men of our country, are invited to use this work as the vehicle for announcing their improvements or discoveries; or to give to the world their useful speculations and projects; and artists and manufacturers to make known their wants as to the imperfection of their operations or processes.

Inventions in 1811.

Philo M. Hackley, of Herkimer county, New York, a perpetual steam still and water boiler, January 11.

James Lee, of Philadelphia, in drying fuel for glass furnaces, January 14.

* Laid before Congress January 21, 1812. The notes are by the Editor, who regrets that it is not in his power to give more information respecting the patents.

Joshua Witherle, of Boston, improved cocks or locks for the passage of fluids, January 16.

Phares Bernard and Timothy Soper, of Whitestown, Oneida county, New York, a steam pump, January 16.

Phares Bernard, of do., a water boiler and steam still, *(a)* January 16.

Michael Morrison, of Boston, a chain float steam boat, January 17.

Augustus Day, of Bordentown, New Jersey, improvement in the sleigh, *(b)* January 19.

Do. of do., a new power by means of combustion, or combustion and explosion, *(c)* January 19.

John P. Swain, of Roxbury, Norfolk, Massachusetts, in co-operating frictionless cylinders, January 24.

Henry Steward, of Clark county, Indiana territory, an expanding and folding wheel, January 24.

Nathanial Burley, of Strafford, New-Hampshire, a vat for facilitating and cheapening the tanning of leather and colouring cloth, January 24.

Joseph Beach, of Northfield, Hampshire county, Massachusetts, in the churn, January 24.

(a) This is in operation; the advantages of it are said to be "trifling expense of construction, a saving of one half the labour, and the production of more liquor from the same quantity of grain, and of a superior quality," than from other modes of distilling.

(b) The Traineau-car, or Chariot Sleigh, is compounded of the carriage and sleigh, so as to use either as circumstances may suit. The running-geer is made precisely similar to that of a coachee, only the wheels are much smaller in the sleigh. When it is used as a sleigh, the runners extend under the rim of the wheels, and are secured to them by means of bolts passing up through the felloes, and confined by nuts and screws. If the snow leaves a person on a journey, the runners are unshipped and placed in rests at the sides of the sleigh, with the curved part turning up behind, which gives them the appearance of springs. The runners are shipped and unshipped with the greatest facility.

(c) The power gained by this machine is considerable in the small model; and it is intended to try the effect of the principle upon a large scale.

David Jewett, of Pittsfield, Massachusetts, in distilling essential oil and spirits, January 24.

John P. Swain and Thomas B. Wait, of Roxbury, Norfolk, Massachusetts, a cylindrical printing press, January 28.

Archibald Binny, of Philadelphia, improved printers' type mould,*(d)* February 4.

Stephen Chandler, of New York, in making rims to ladies' and taylors' thimbles, without soldering them, February 4.

Borden Wilbor and Timothy Soper, of Washington county, New York, in the water boiler and steam still, February 4.

Borden Wilbor, of do., in making salts by evaporation, February 4.

Archibald Binny, of Philadelphia, for smoothing or rubbing printers' types,*(d)* February 4.

Stephen Chandler, of New York, in making rims to ladies' and taylors' thimbles, without soldering them, February 4.

Volkert Vedder, of Amsterdam, Montgomery county, New York, in forming, heating, removing, and using metal plates in pressing woollen cloths, February 6.

Robert Hancock, sen. and Edward W. Carr, of Philadelphia, in the cottin gin,*(e)* February 6.

Lewis Cleveland, of Holliston, Middlesex county, Massachusetts, in the churn, February 7.

John Sanders, of Schenectady, New York, in making ardent spirits out of the juice of southern corn stalks, called the horse-tooth or Virginia corn, February 7.

John P. Swain and Jacob Skinner, of Roxbury, Norfolk county, Massachusetts, a machine for cutting nails or brads, February 8.

Robert Fulton, of New-York, for constructing boats or vessels which are to be navigated by the power of steam engines, February 9.

(d) These are part of the various improvements in type founding brought forward by Binny and Ronaldson, and now in operation.

(e) One of these gins has been sent to North Carolina, but its merits are not yet known.

(To be continued in the next number.)

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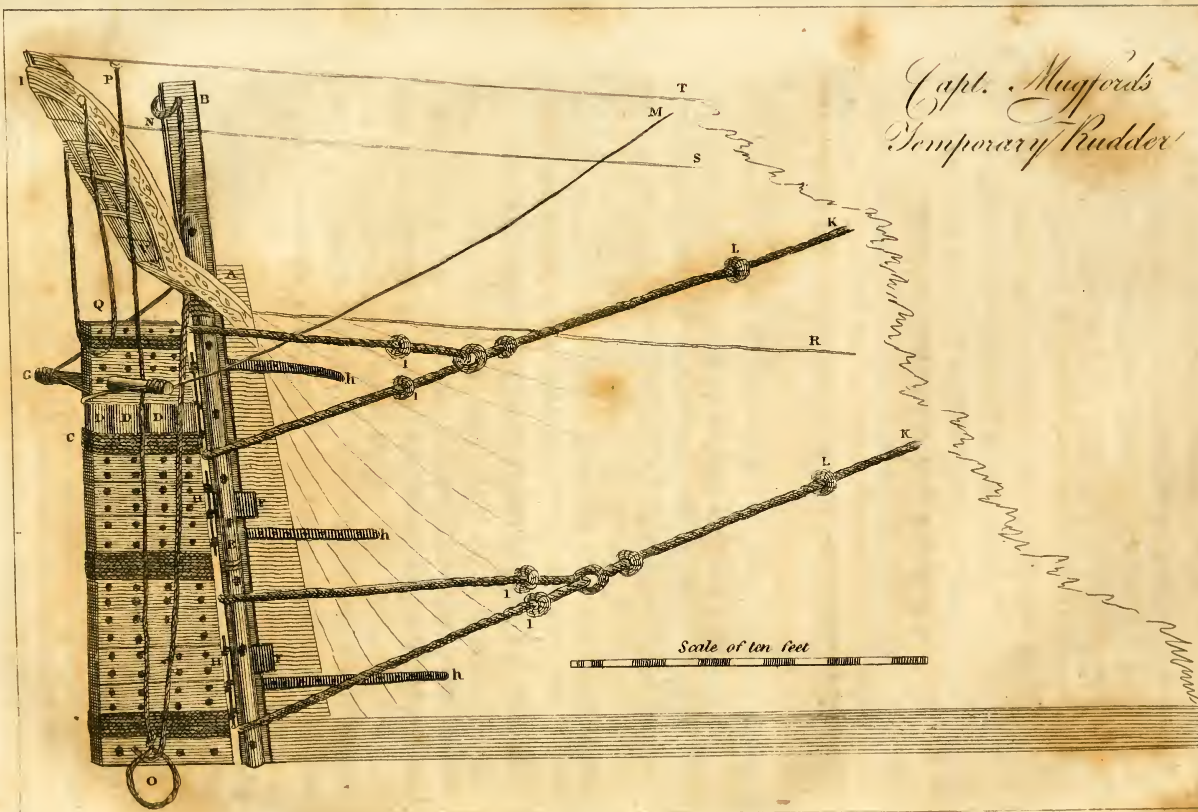

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PAPERS ON COMMERCE.

An Account and Description of a TEMPORARY RUDDER, *invented by Captain William Mugford, of Salem, Massachusetts.**

Read November 16*th*, 1804.

THE ship Ulysses of Salem, (Massachusetts), under the command of captain William Mugford, sailed from that port on the 2d day of January 1804, bound to Marseilles. On the 5th of that month, being in latitude 41, longitude 65, from the meridian of London, she experienced a heavy gale of wind, and while running 8 and 9 knots, a large sea struck her stern and carried away the rudder at the water's edge, when the vessel immediately broached to. The main-mast was sprung and the hull lay exposed to every sea. In this unfortunate situation, captain Mugford was reduced to the necessity of steering the ship with cables over the quarters, for upwards of twenty days, making however the best of his way towards the Western Islands and Madeira. The weather during all this time was extremely bois-

* From the Transactions of the American Philosophical Society, Vol. vi. p. 203. The Society awarded to the inventor a Gold Medal, from the Extra Magellanic fund.

terous, and the ship much exposed to the sea. It was during this interval that captain Mugford planned and executed his temporary rudder. This rudder is made of a spare top-mast and other spars well lashed and secured together, and fastened to a false stern-post by eye-bolts serving as braces, and crowbars and other substitutes for pintles. The false post is also firmly secured to the old stern-post by the guys and old rudder braces which are tennoned into it, tiller ropes are fixed to each end of an old iron tiller; or for want of it, an iron anchor-stock, or a piece of scantling, or a spar is fixed across the rudder and supported with rope-braces, so that the vessel is steered in the usual manner with the wheel: and in order to keep this rudder steady in its place, while fixing it, a cannon or some other sufficient weight is fastened to the bottom of it.

Captain Mugford (after observing that great difficulty would be avoided in the construction, if the master of every vessel was in possession of the measure of the rudder and the precise distance of the gudgeons) informs us, that he found it to answer every purpose which could be expected from a temporary rudder, that his vessel was found to steer by it with the greatest ease, and that he sailed with it during fifty days, at the end of which time he arrived in safety at the port of his destination.

The drawing of the rudder, the following description of it, and the remarks subjoined, were furnished to the society by captain William Jones, one of their associates, from the model of the rudder sent by the inventor and deposited in the cabinet of the society.

MUGFORD'S TEMPORARY RUDDER.

A, (see the plate) is the main stern-post from which the original rudder has been torn.

B, Is the *false stern-post* made of a spare top-mast sided so as to fit the main stern-post, with mortices to receive the braces h h h, or the fragments thereof which remain upon the post.

C, Is the temporary rudder made of the (residue of the) top-

mast and the sprit-sail yard, studding-sail booms, or any spars that can be spared with the least inconvenience—They are cut to the proper length and partially sided and firmly bolted or *tree-nailed* together. The sides are then flatted a little with the adze, and boards nailed across and wooldings of rope bind the whole together as represented in the figure.

D D D D, Represent the spars of which the rudder is constructed.

E, Is a small spar or piece of plank fitted on each side of the false post to lead the guys clear and prevent their chafing; they are also bolted through from side to side and rivetted to secure the false post from splitting, or if bolts are not to be had, lashings are substituted as represented in the figure.

F F, Are stout flat cleats well nailed or bolted on each side of the false post under the spars E, and embrace the main post. Their use is to sustain the false post against a lateral shock.

G, Is a yoke made of an iron tiller, or other sufficient substitute, firmly fitted through the after part of the rudder near the surface of the water.

H H H, Are the temporary braces and pintles. They are formed of eye-bolts drawn out of the gun carriages or from the various parts of the hull, masts, or caps, and driven into the false post or rudder alternately, so that the eyes just meet each other; some of those in the post, below those in the rudder, and others above, in order to confine the rudder from rising. The pintles are made of crowbars, a kedge anchor-stock, or the long stout bolts out of the windlass bits.

h h h, Are the old rudder braces or the fragments thereof remaining on the post.

I, Is the profile of the stern of the ship.

K K, Are guys, the bites of which are well served and lashed to the after part of the false post, and lead separately (or combined as represented in the figure) to the fore and after parts of the main chains.

L L, Are knots worked on the guys to preserve them from chafing against the bottom and quarters.

M, Is a rope, the bite of which is lashed to the after part of the rudder below the yoke, and also to the extremities of the yoke, and from thence led through blocks attached to the end of a spar projecting over each quarter to the wheel by which the ship is steered.

N, Is a slip rope rove through a hole in the heel of the rudder, and both ends passed up through the rudder case to the head of the false post and made fast.

O, Is a grommet (travelling on the slip rope) to which a gun or kedge anchor, or any sufficient weight is attached, in order to sink the rudder until it is hung and secured.

P, Is a hauling line attached to the grommet, and by which the weight is lowered down and hauled up. When the rudder is secured in its place, the weight is removed, and the slip rope unrove.

Q, Are the rudder pendents to save the rudder in case of accident.

R, Is the lower deck.

S, Is the quarter deck.

T, Is the quarter rail.

V, The arch board of the stern.

REMARKS.

The merit of this invention is to be tested by a just comparison with the best substitute hitherto known, which is undoubtedly that of captain Pakenham's excellent invention, an account and description of which may be found in the 7th volume of the Transactions of the London Society for the encouragement of arts, manufactures, and commerce.

The difference consists in captain Mugford's new and ingenious contrivance of a *false stern post*, to which his rudder is secured by eye-bolts serving as braces, and crowbars or other substitutes as pintles, on which it works with as much ease and effect as the original rudder. The false post is also firmly secured to the main post by the guys, and the old rudder braces which are tennoned into it.

Captain Pakenham's rudder depends entirely upon the very slight hold which the cap has on the post, and does not appear to be sufficiently secured to resist a sudden lateral shock; it is, however, very simple in its construction, and requires, perhaps, less labour and fewer materials (particularly of iron) than captain Mugford's, and has the advantage of steering upon deck with a common tiller in the usual way.

Captain Mugford's rudder must work with much less friction, and consequently will require less power, as the axis on which it moves is only an inch and a half in diameter, whereas that of captain Pakenham's is the diameter of the top-mast; say 10 or 12 inches.

Upon the whole, as the construction of captain Mugford's rudder requires only the skill and materials which are usually to be found on ship board, and as it appears to be better secured, and works with more ease than captain Pakenham's, it may (without derogating from the merit of the latter) be justly considered as a valuable and useful invention.

Captain Mugford's rudder is susceptible of a very simple and important improvement, viz. If the archboard of the stern V was cut off, and the after part of the rudder case taken down, the stock of the rudder might be continued to the upper deck, and steer with the tiller in the usual way. Captain Mugford's mode of steering is exceptionable, as the yoke is at the surface of the water, and the wheel ropes leading from the yoke to the spar, broad upon the quarter; the angle which the rope makes with the yoke when the rudder is hard over, is so obtuse as greatly to diminish the effort of the power; and moreover the rudder is necessarily so broad at the surface of the water, as to expose a dangerous resistance to the action of the sea.

It is also to be observed, that few merchant ships under 350 tons burthen have either wheel or iron tiller. If the rudder was continued to the deck, the breadth might be diminished at the surface of the water and enlarged at the heel, which would increase its effect and render it less liable to injury.

In the drawing, the cleats F F, are added to the side of the

false post, and overlapping the main post, which will give it great additional security. Some minor alterations are also made, viz. In the drawing the four guys 1 1 1 l, (which are separate in the model) are combined into two K K, leading through a thimble or clinch; the reason is, that a more equal tension can be obtained of two ropes than of four, and that when combined they lead in a fairer direction under the buttock of the ship.

Indeed the number of guys are superfluous, the lower one would be amply sufficient, as the upper end of the post can be made very secure. Captain Pakenham has but a *single* guy leading from the cap on each side.

The drawing represents a mode of applying and removing the weight to sink the rudder, by which the whole can be removed with more ease when the rudder is secured.

When the rudder is fixed, the only apprehension is, the guys chafing off. There is however on board every ship a complete remedy, viz. take two of the topmast back stay chain plates and one of the bolts, and bolt them to the heel of the false stern post, one on each side; to these hook the top-blocks and mouse the hooks well; then reeve the guys through the blocks, and take both parts to the forepart of the main chains: by this means the guys may be overhauled through the blocks and examined at pleasure, keeping them always well taught and veering away one part as you haul in upon the other. These remarks are the more diffuse as the subject is considered important, and is still susceptible of great improvement.

Captain Mugford was some days before he could hang his rudder, owing to bad weather.

The man will deserve well who shall invent a simple substitute for a rudder that can be made and applied immediately *in any weather;* and it need not be despaired of, if men of ingenuity, without waiting for the calamity, would only try experiments while their ships are in a sound state.

ON THE WEEVIL IN SEA BREAD.

THE fatal effects of the Weevil in Sea Bread have long been severely felt by seamen employed on long voyages: rewards have been humanely offered by governments and patriotic societies for a cure or preventive, but hitherto without success. The following fact was discovered by accident, and is now offered to the public as a hint worthy the attention of those who may be employed in supplying ships with provisions, or to captains and the owners of vessels, and may, in all probability, lessen, if not wholly remove an inconvenience so injurious to navigation.

A bag belonging to a powder-mill fell into a cauldron of liquid nitre; it was immediately taken out, plunged into cold water, and hung up to dry. Several days after this circumstance the bag was filled with Sea Biscuit and sent on board a West-Indiaman, where it was stowed away among the captain's stock. The vessel was nine months out of England before she proceeded on her passage home, when she got becalmed and remained so long in that situation, that her crew were forced to be put on half allowance, more particularly so, as their bread was much destroyed by Weevils, and was hourly consuming. The captain at this time wishing to make use of the bag abovementioned, which had not been opened since the ship left England, ordered it to be examined, when greatly to his susprise, the whole contents were found to be perfectly sound, without any appearance of having been injured by any insect whatever: a circumstance solely to be attributed to the quality of the bag.

The editor has been informed of another plan of preserving Ship Bread having been adopted with success, which it may be useful to mention, inasmuch as the means of following it are at all times attainable in sea-ports. It is to put the Biscuit in tierces which had recently contained brandy, gin, whiskey, or rum, and heading them up tight. It is said that a vessel belonging to Connecticut, on board of which this method was adopted, brought home bread, in good condition, which had gone from the United States to China by way of the north-west coast of America.

A HUMANE HINT TO MASTERS OF VESSELS.

THE following benevolent hint was given in the public prints soon after the publication of the account of the loss of the ship mentioned. As an attention to the advice may save the lives of many, it has been deemed important to preserve it.

"Would it not be well worth the while, when at sea, to send a man, or men, aloft, several times in the course of a day—say in the morning—at noon—before dark in the afternoon, and oftener if convenient, to look round for any unhappy brother tars, who might be on a wreck, in a boat, or otherwise in distress?

"It appears by the report of the three men picked up in the Margaret's small boat,* that several vessels passed near the wreck before they left it, and the boat was so near one of them, as to see the men on her deck;—yet it must be presumed that neither of those vessels saw either the wreck or the boat. If they had adopted the regulation above suggested, is it not probable that one of them would have discovered the wreck, saved a number of good fellows, and obtained a valuable prize into the bargain?

"It is by no means intended that a master of a vessel should chase every thing which he may see, and it is allowed that he ought to be careful not to vitiate his Policy of Insurance, by cruizing for or taking prizes. Discretion should be used in this case as well as in others.

A FRIEND TO HUMANITY."

* The ship Margaret was wrecked in lat. 40. N. long. 39. 30. W. in May, 1810, on her voyage from Naples to Salem. EDITOR.

Quantity of particular articles, the produce of the United States, exported from 1800 *to* 1811.*

COTTON.

	To all parts of the world.	To France.	To England.
	lbs.	*lbs.*	*lbs.*
1800	17,789,803	none	16,179,513
1801	20,911,201	844,728	18,953,065
1802	27,501,075	1,907,849	23,473,925
1803	41,105,623	3,821,840	27,757,307
1804	38,118,041	5,946,848	25,770,748
1805	40,383,491	4,504,329	32,571,071
1806	37,491,282	7,082,118	24,256,457
1807	66,612,737	6,114,358	53,180,211
1808	12,064,346	2,087,450	7,992,593
1809*	53,210,225	none direct	13,365,987
1810†	93,874,201	do.	36,171,915
1811‡	62,186,000	do.	46,872,452

RICE.

	Tierces.	Tierces.	Tierces.
1800	112,056	none	77,547
1801	94,866	2,724	65,022
1802	79,822	7,186	37,393
1803	81,838	3,116	33,200
1804	78,385	6,014	24,975

* From the Address of the Minority of the Members of the Congress of the United States to their Constituents, on the subject of the War with Great-Britain.

† In 1809, in consequence of the Embargo and Non-intercourse Act, 4 million of pounds of Cotton were shipped for Madeira, 10 and a half millions to the Floridas, 6 millions to Fayal and other Azores, 1 million and three quarters to Portugal, and 10 millions to Sweden.

‡ 1810, about 4 million of pounds of Cotton were shipped for Spain, 3 millions for Portugal, 3 millions for Madeira, 10 millions for the Floridas, 2 millions for Europe generally, 4 millions for Fayal and the Azores, 14 millions for Denmark and Norway, and 5 millions for Sweden.

§ In 1811, 9 million of pounds of Cotton were shipped for Russia.

RICE.

	To all parts of the world. Tierces.	To France. Tierces.	To England. Tierces.
1805	56,830	1,601	24,737
1806	102,627	3,392	39,298
1807	94,692	3,006	37,417
1808	9,228	none direct	4,298
1809	116,907	do.	32,138
1810	131,941	do.	31,118
1811	119,356	do.	40,045

TOBACCO.

	Hhds.	Hhds.	Hhds.
1800	78,680	143	37,798
1801	103,758	5,006	55,256
1802	77,721	16,216	29,938
1803	86,291	9,815	47,829
1804	83,343	14,623	24,700
1805	71,252	12,135	18,169
1806	83,186	9,182	26,272
1807	62,232	2,876	28,047
1808	9,576	566	2,526
1809	53,921	none direct	8,965
1810	84,134	do.	24,067
1811	35,828	569	20,342

FISH, Dried or Smoked.

	Quintals.	Quintals.	Quintals.
1800	392,727	none	141,420
1801	410,948	1,687	111,030
1802	440,925	27,067	92,679
1803	461,870	3,491	71,495
1804	567,828	3,765	76,822
1805	514,549	73,004	55,676
1806	537,457	19,347	66,377
1807	473,924	87,654	55,242
1808	155,808	16,144	26,998

FISH, Dried or Smoked.

	To all parts of the world.	To France.	To England.
	Quintals.	*Quintals.*	*Quintals.*
1809	345,648	none	66,566
1810	280,804	2,150	55,456
1811	216,387	28,622	33,242

PICKLED FISH.

None exported to European France.

FLOUR.

	Bbls.	Bbls.	Bbls.
1800	653,052	none	365,739
1801	1,102,444	none	758,023
1802	1,156,248	14,628	484,886
1803	1,311,853	18,045	502,006
1804	810,008	1,074	258,515
1805	777,513	none	235,176
1806	782,724	none	308,048
1807	1,249,819	none	619,918
1808	263,813	none	73,084
1809	846,247	none	230,822
1810	798,431	none	192,477
1811	1,445,012	2,966	275,534

NAVAL STORES—TAR.

	Bbls.	Bbls.	Bbls.
1800	59,410	none	58,793
1801	67,487	none	62,632
1802	37,497	797	21,330
1803	78,989	none	75,295
1804	58,181	do.	45,210
1805	72,745	do.	59,439
1806	62,723	do.	50,663
1807	59,282	do.	51,232
1808	18,764	do.	17,700
1809	128,090	do.	33,072
1810	87,310	do.	50,021
1811	149,796	do.	123,034

TURPENTINE.

	To all parts of the world.	To France.	To England.
	Bbls.	*Bbls.*	*Bbls.*
1800	33,129	none	32,580
1801	35,413	do.	35,143
1802	38,764	do.	36,769
1803	61,178	do.	60,732
1804	77,825	do.	76,950
1805	95,640	do.	94,328
1806	74,731	do.	71,854
1807	53,451	do.	52,107
1808	17,061	do.	17,009
1809	77,398	do.	22,885
1810	62,912	do.	36,995
1811	100,242	do.	97,250

LUMBER.

Of the vast quantities of Lumber exported from 1800 to 1811, only a few Staves and Heading went to France, as follows, viz.

	Thousands of Staves and Heading.
1801	6,349
1803	357
1804	321
1805	466
1806	716
1807	614
1808	105

PAPERS ON MANUFACTURES.

ON THE MANUFACTURE OF VITRIOLIC ACID.

Communicated by Thomas Cooper, *Esq.*
Professor of Chymistry in Dickinson College, Carlisle.

THE process in the large way for making Vitriolic Acid is as follows. Set up the frame of a room 20 feet by 30 feet, and 18 feet high. Of this room, the sides and the ceiling should be lined with milled lead, about 6 lb. to the foot. The bottom should be of lead 8 lb. to the foot, with a plug to let off the liquor close. Two feet six inches from the bottom, on the 20 foot side, should be, at equal distances from the sides and from each other, two trap doors eighteen inches square, that move up and down in a groove by means of a pulley. Opposite to each of these trap doors should be an iron frame about a foot wide in the clear, and set on leaden feet, or lumps of lead, four inches at least from the bottom of the room. Each of these frames are destined to hold three or four stone ware, or porcelain pans, 15 inches diameter, and 4 inches deep, which are to be half filled with brimstone and saltpetre, ground together and sifted, in the proportion of 8-9ths of brimstone and 1-9th of saltpetre. Fix the pans on the frames or tressels, light the mixture by a redhot iron, shut the trap doors, and let them burn. The nitre supplies oxygen to the sulphur, which is converted into volatile vitriolic acid. If water could be admitted on the top, and outside of the room, the condensation would be assisted. Much volatile nitrous acid is also disengaged by the action of the new-formed vitriolic acid on the saltpetre, which may occasionally be let out by a trap door on pulleys, towards the top of the further side of the room. When the pans of the mixture are extinguished, leave the room close for an hour before you take them out; then empty, fill, and light them again. After three burnings, a jet of cold water may

be thrown in by a hand pump, so as to extend in a scattered rain-like stream, through the room. Then open the trap doors and admit a current of air. Do not throw in too much cold water, as it will require more fuel. Draw off the contents at the bottom, and evaporate for two hours by a strong fire, in leaden retorts, or pans; then finish in large glass retorts in a sand bath. In England, the glass retorts, hold 90 lb. of oil of vitriol, when concentrated, which is one half too much, for unless the men are very careful, they are apt to break them. In Scotland they concentrate entirely in lead. Oil of Vitriol should weigh 29 1-2 oz. to the wine pint, measured and weighed in a Florence flask. According to the late experiments of Mr. Chevenix, Vitriolic Acid consists of 61.5 of sulphur, and 38-95 oxygen to 100 parts of acid. If the Oil of Vitriol be black, a tea-spoonful of nitre will clear it. The residue of the pans may be ground with the brimstone and burnt again. The pans would be better if they ran upon small inch wheels in a groove in the frame, and were drawn out by a crooked iron.

ON GOLD LEAF.

GOLDBEATER'S SKIN. SILVER LEAF. DUTCH GOLD.

Dr. LEWIS, in his "*Commercium Philosophico-Technicum*,*" first gave the public an account of the process adopted by artists in making Gold-Leaf, which has been copied by all writers since his time. But Mr. Nicholson, of London, whose authority upon all subjects connected with the arts is very great, because he goes to the fountain head for information, says† that Lewis's assertion of the high state of purity of the metal in Gold-Leaf is a mistake.

"It is," says he, "never pure, because pure gold is too ductile to be worked between the goldbeater's skin. The newest skins will work the finest gold, and make the thinest leaf, because they are the smoothest. Old skins, being rough or foul, require

* London 1763. † Philosophical Journal, Vol. I, 4to.

coarser gold. The finer the gold, the more ductile: insomuch that pure gold, when driven out by the hammer, is too soft to force itself over the irregularities, but would pass round them, and by that means become divided into narrow slips. The finest gold for this purpose has three grains of alloy in the ounce; and the coarsest twelve grains. In general the alloy is six grains, or one-eightieth part. That which is called pale gold, contains three pennyweights of silver in the ounce. The alloy of leaf gold is silver or copper, or both, and the colour is produced by various tints accordingly. Two ounces and two pennyweights of gold are delivered by the master to the workman, who, if extraordinarily skilful, returns two thousand leaves, or eighty books of gold, together with one ounce and six pennyweights of waste cuttings. Hence one book weighs 4.8 grains, and as the leaves measure 3.3 inches in the side, the thickness of the leaf is one two hundred and eighty-two thousandth part of an inch."

The gold is beat on a smooth block of black marble, from two hundred to six hundred pounds in weight, and about nine inches square on the upper surface, fitted into the middle of the wooden frame, about two feet square, so as that the surface of the marble and frame form one even plane. Three of the sides are furnished with a high ledge, and the front, which is open, has a leather flap fastened to it, which the goldbeater uses as an apron, for preserving the fragments of gold that fall off. Three hammers are employed in this business, having two round and somewhat convex faces: the first, called the cutch hammer, is about four inches in diameter, and weighs fifteen or sixteen pounds: the second, called the shodering hammer, weighs about twelve pounds, and is about the same diameter: the third, called the gold or finishing hammer, weighs ten or eleven pounds, and is nearly of the same width. The French use four hammers, differing both in size and shape from those of our workmen.

The goldbeaters also use three kind of animal membranes; some of which are laid between the leaves to prevent their uniting together, and others over them to defend them from injury by the action of the hammer. For the outside cover, they use

common parchment made of sheep-skin; for interlaying with the gold, first, the smoothest and closest vellum made of calves' skin; and afterwards, the much finer skins of ox-gut, stript off from the large straight gut slit open, prepared on purpose for this use, and hence called *goldbeater's skin.* The general process of their preparation, is said to consist in applying one upon another, by the smooth sides, in a moist state, in which they readily cohere and unite inseparably, stretching them on a frame, and carefully scraping off the fat and rough matter, so as to leave only the fine exterior membrane of the gut, beating them between double leaves of paper, to force out the remaining unctuosity; moistening them once or twice with an infusion of warm spices, and lastly, drying and pressing them. It is said, that some calcined gypsum, or plaster of Paris, is rubbed with a hare's foot, both on the vellum, and ox-gut skins, which fill up their pores, and prevent the Gold-Leaf from sticking. These skins, after seventy or eighty repetitions, become unfit for use; but their virtue may be restored by interlaying them with leaves of paper moistened with vinegar or white wine, beating them for a whole day, and afterwards rubbing them over with plaster of Paris: and even holes in them may be repaired by the dexterous application of fresh skins.

The manner of preparing and beating gold. They first melt a quantity of gold and alloy, in a black-lead crucible, with some borax, in a wind furnace, and pour it into an iron ingot mould, six or eight inches long, and 3-4ths of an inch wide, previously greased and heated; the bar of gold is made redhot and forged on an anvil into a long plate, which is farther extended, by being passed repeatedly between polished steel rollers, till it becomes a ribband, as thin as paper. This ribband is divided by compasses, and cut with shears into equal pieces, which are forged on an anvil till they are an inch square, and afterwards well annealed. Two ounces of gold, which is the quantity melted at a time, make a hundred and fifty of these squares, so that each of them weighs six grains and two fifths; and as 4902 grains of gold make a cubic inch, the thickness of the square pieces is

about the 766th part of an inch. All these squares are interlaid with leaves or vellum, three or four inches square; one leaf being laid between every two of them, and about twenty more of the leaves are laid on the outsides; over these is drawn a parchment case open at both ends, and over this another, in a contrary direction, so that the vellum and gold leaves are kept tight and close. The whole is then beaten with the heaviest hammer, till the gold is stretched to the extent of the vellum: the pieces taken out of this case or mould, are cut in four with a steel knife; and the six hundred pieces thus produced are interlaid in the same manner, with pieces of the ox-gut skins, five inches square. The beating is repeated with a lighter hammer, till the golden plates have acquired the extent of the skin; when they are divided into four by a piece of cane cut to an edge. The whole number of leaves is then divided into four parcels, which are interlaid, as before, and beaten separately, till they are stretched for the third time to the size of the skins. The French repeat the division and beating once more. After the last beating, the leaves are taken up by the end of a cane instrument, and being thrown flat on a leather cushion, are cut to a size, one by one, with a square frame of cane made of a proper sharpness, or with a frame of wood edged with cane. They are then fitted into books of twenty-five leaves each, the paper of which is well smoothed, and rubbed with red bole to prevent their sticking to it. The size of the French gold leaves is from somewhat less than three inches to 3 3-4 square; that of the English from three inches to 3 3-8.

Silver-Leaf is said to be pure silver. It is extensible in this way when compared with gold, rather more than in the proportion of their specific gravities. Some leaf silver which Mr. Nicholson tried, was thicker than the gold in the proportion of seven to four. So that the weight of metal covering equal surfaces approached to equality.

The *Yellow Metal* called *Dutch Gold*, is made from copper-plates by cementation with calamine, without subsequent fusion. Its thickness, compared with that of leaf gold, proved as nine-

teen to four, and under equal surfaces it is considerably more than twice as heavy as the gold.* By another authority it is stated to be "only copper leaf coloured by the fumes of zinc."†

The consumption of this article is immense. Twenty tons of it have been sent at a time from England to Surat and to the other parts of the peninsula of India, for the dresses of the females of the country, their priests and gods.‡ It is also used for inferior binding, for coarse gilding by painters, dolls for children, theatrical dresses, and as a substitute for real gold leaf on many other occasions. Zinc abounds in the United States, and even so near Philadelphia as Perkiomen, but before this manufactory can be introduced, the business of rolling copper must be set on foot. At present Dutch Metal is manufactured chiefly in Holland and Germany.

GENERAL VIEW

OF THE

MANUFACTURES OF THE UNITED STATES.

DURING the last session of Congress, Dr. Mitchell, member of the House of Representatives from New-York, was requested by the Committee of Commerce and Manufactures to examine the returns made by the marshals, on the state of the manufactures, and agricultural products of the United States, while they were taking the census of the people during the year 1810. The reports were accordingly submitted to him, and he undertook the task of making a general abstract; and of deducing a sort of comprehensive table. But the returns of many of the States were incomplete, particularly that from South Carolina, a circumstance that rendered it impossible to arrange the

* Nicholson's Philosophical Journal, Vol. I, 4to.
† Imison's Elements of Science, Vol. II, p. 526.
‡ Tradesman, April 1809, p. 313.

materials into one compendious view. He notices the returns from Massachusetts and Pennsylvania, as being examples of order, perspicuity, and research. The following are the principal facts afforded by an examination of the returns.

New-York gave 867 tanneries, 491 distilleries, 42 breweries, 33,068 looms, 467 fulling mills, 413 carding machines, 20 cotton manufactories, 28 paper mills, 124 hatteries, 6 glass houses, 2 powder mills, 18 rope-walks, 10 sugar refineries, 28 oil mills, 11 blast furnaces, 10 air furnaces, 44 cut nail manufactories, 48 forges, besides cloths.

Ivory, Horn, and Tortoise-shell—Massachusetts, annual value, $ 80,624—Connecticut, do. $ 70,000—Pennsylvania, $ 6,240—equalling a sum of $ 156,864.

Copperas—W. Tennessee, 56,000 lbs.—Vermont, 8000 lbs.

Ardent Spirits, including Rye Whiskey, Rum, Apple and Peach Brandy—3,720,000 gallons.

Water and Horse Mills employed in spinning cotton in August 1810, 330, working 100,000 spindles; these on an average will spin annually between four and five million pounds of yarn, and that yarn would be sufficient to weave 18 million yards of cotton cloth, 3-4th of a yard wide: and this is independent of domestic spinning.

Fulling Mills, 1630.

Wool-Carding Machinery going by water, 1585.

Looms, 330,000, and the total number of yards of cloth, made of wool, cotton, and flax, as returned, exceeds 75 millions.

Gunpowder Mills, 207, and prepare yearly 1,450,000 lbs. of powder.

Forges, Furnaces, and Bloomeries, 530.

Paper Mills, 190.*

Sheep—Vermont, returned 450,000—Massachusetts, 399,182—Connecticut, 400,000—Pennsylvania, 1,469,918.

* Of these, 76 are in the States of Delaware and Pennsylvania, and work 93 vats, according to the report at a general meeting of the trade in Philadelphia, in 1811. Editor.

Salt Petre—Virginia prepares annually 59,175 lbs.—Kentucky 201,937—Massachusetts, 23,600—East Tennesse, 17,531—West Tennessee, 144,895—making nearly half a million pounds of home-made nitre, as good as that brought from foreign parts.

Straw Bonnets—Massachusetts, yearly value, $551,988—Connecticut, $27,100.

Maple Sugar—Ohio, annual produce, 3,023,806 lbs.—Kentucky, 2,471,647—Vermont, 1,200,000—East Tennessee, 162,340 lb.

The number of looms, and of carding and spinning machines almost exceeds belief, as does also the amount of cloth prepared by the inhabitants. The woollen manufacture has prodigiously increased, as well in the quality and variety, as in the quantity of the goods. Such advances are already made toward supplying domestic fabrics enough to clothe the people, that but a few years more will be necessary, under the existing commercial restrictions, to effect that important object.

The fabrics of flax are also far extended, and so much on the increase, as to excite the most cheering prospects of an augmented supply to our citizens from their own proper labour and skill. The superior excellence of homespun linen is the strongest of all recommendations. Thus far Dr. Mitchell.

To the above statement may be added a particular account of the cotton mills in three states, all within 30 miles of the town of New-Providence, Rhode-Island. Thirty-eight factories, contain 30,663 spindles, but 53,246 might run in the building. In Massachusetts, 30 factories contain 17,371 spindles, but 43,458 might run—In Connecticut 76 factories contain 51,454 spindles, but have room and power enough for 111,600 spindles.

Finally, the rapid multiplication of sheep in the United States, the increased cultivation of the fuller's teazle, the improving state of our knowledge in the art of dyeing, and the discovery of inexhaustible beds of the invaluable fuller's earth, the great increase of the wire-drawing business,* and the expeditious mode

* Iron wire is now drawn in Connecticut; at Burlington, Vermont; at Philadelphia, and Pittsburgh, and will be shortly commenced by the "Wire Company," incorporated by the State of New-York.

of making cards by Whittemore's plan, are all sureties for the successful prosecution of the woollen manufacture in the United States.

Had the returns of the marshals on the manufactures and agricultural stock of the United States, which was made in pursuance of the third census law, and sent last year to government, been published at length, facts would have been brought to light, of which a large portion of our citizens have no idea. The friends to the prosperity and independence of their country will rejoice to hear, that a complete report on this interesting subject is making out by a gentleman,* whose attention has been officially drawn to the resources of the United States for some years past.

It is worthy of notice, that although in the New-England States, and in New-York, there are numerous establishments for the manufacture of woollen cloth, and that in Pennsylvania there are none except for coarse woollens, and these on a small scale, yet, that this state contains so many more sheep than any other noticed in the report, and it is believed than any other state in the Union. As not a pound of wool has ever been exported from Philadelphia, the conclusion is, that the whole of the wool produced by the 1,469,918 sheep, must have been worked up. Wool-carding machines are erected on almost every stream in the state, and at these the wool is made into rolls, which are spun in the families of the farmers. Weavers and fullers also abound, who weave, dress, and dye the cloth. The average produce of each sheep may be fairly estimated at three lbs. of washed clean wool, at the lowest computation, fit for carding or combing; and giving the result of 4,409,754 lbs. of wool, according to the returns of sheep. From this circumstance, an opinion of the extent of the domestic manufactures of the State may be formed. The returns are, however, inaccurate, for in the blanks accompanying the letter of instructions to the marshal's deputies, no notice was taken of the invaluable new Leicester or Bakewell sheep, which, happily for the country, are rapidly spreading

* Tench Coxe, Esq. late Purveyor of Public Supplies.

through the States of New Jersey, Pennsylvania, and New-York. These sheep, from their beautiful forms, take on fat very speedily and carry wool of a good quality, some of which will comb well, and will make excellent blankets and worsted: the shorter staple make cloths of a second quality in England.

ACCOUNT OF IMPROVEMENTS IN THE MECHANICAL ARTS.*

Turkish, or Oriental Paste.

THE jewellers of Paris have of late years formed many handsome ornaments, such as ear-rings, bracelets, broaches, made of a kind of stone or perfumed paste. On the examination of this mock jewellery, it has been found to be made from the *Japan earth*, known by the name of *mimosa catechu*, an article well known in the *materia medica*, and being mixed with musk or ambergris to render it perfumed, and diluted with gum dragant, it is rendered into the requisite form by proper moulds, according to the following process:

They first take the requisite quantity of *cachou*, reduced into small bits, on this is then poured eight times its weight in equal quantities of strong vinegar and rose water; this mixture is then put into a glass bottle stopped with a piece of moistened bladder, pierced with a pin-hole to give access to the air, it is then placed in a sand bath, or on a stove moderately heated, until the cachou is dissolved.

Thus dissolved it is suffered to grow cool, and then filtered through gray paper; it is then put into a retort, to which is attached a recipient. The whole of the spirit is then distilled, until it emits nothing but clear water.

The residue at the bottom of the retort is then put into a china bowl, and to every ounce of dissolved cachou is then added half

* From the French Archives of Inventions and Discoveries for 1810, and Bulletin des Neusten aus der Naturwissenschafft of Hermbstadt. Translated for the Tradesman, July, 1810.

a drachm of the solution of gum dragant, and the whole is mixed up into a thick paste, which congeals in the cold. Whilst the paste remains ductile, there is added the quantity of from four to six grains well pulverized, to the quantity of every half ounce, and the whole is to be well mixed up together.

This preparation of the paste is then put into the requisite shaped moulds made of either copper or brass, and the inside of which must be well polished, and anointed with oil of almonds or jessamine, to prevent the paste from adhering thereto. It is then covered over and left to harden gradually.

In this manner are made every requisite fancy ornament, and to which can be given a variety of odours, such as roses, cinnamon, bergamot, &c. &c.

Turkish Pearls.

These are much used by the jewellers abroad in various ornaments, and being perfectly *black*, form a beautiful relief to the common pearl or composition, as well as to ornaments of gold and silver. These are also composed of *cachou* or *terra Japonica*, as beforementioned, by the following preparation.

Two ounces of pulverized cachou is dissolved in eight ounces of rose water, of a gentle heat, which is then filtered through a linen cloth; after which the liquor is evaporated until the residue is reduced to about three ounces. To this is mixed half an ounce of *iris of Florence* in powder, with twelve grains of musk and twenty drops of oil of bergamot or lavender, the whole being well mixed together. After this, two drachms of pulverized isinglass is dissolved in a sufficient quantity of water over a slow fire, adding thereto two drachms of lamp black, which is then mixed with the former composition, so as to form a black paste of a strong consistence. To form the pearls of an equal and uniform shape and size, the same machine can be employed as is used in forming medicine pills; when this is done, they are simply pierced by a needle dipped in oil of almonds, and immerged in the same kind of oil or any other, to give them the requisite odour, and are left to dry gradually.

The colour of these pearls as well as the scent can be varied according to fancy, by using different colouring articles.

These kind of pearls form a considerable traffic, in the various trinkets and ornaments on the continent.

The following methods of obtaining colours for dyeing are extracted from the *Journale fur Technologie*, par M. Juch; and from the Journal Hollandois, par M. Tiboel, under the title of *Scheikundige Mengelstoffen:*

To make a Vegetable Blue.

Gather a sufficient quantity of the common field *blue bottles* of the deepest colour, together with the cup of the flowers, which are to be dried a little upon a stove of a moderate heat. The flowers in this state (half dried) are to be steeped with gum-arabic water, and the whole kneaded together; this paste is then to be placed between paper, and strongly compressed between boards. They are left in this state some days, when it is bruised in a stone mortar, adding thereto a small quantity of allum dissolved in water. It is then filtered, and the liquor thus filtered, is evaporated in a china vessel, and the residue at the bottom thereof is the finest vegetable blue.*

* The following receipt to dye *a never-failing blue*, has been recently published: of its merits the editor knows nothing.

Take one pound of logwood, boil it in an iron pot four hours, in as much water as will cover three pounds of flaxen yarn when boiled; then put in your thread and let it remain a few minutes, take it out and add two ounces of blue vitriol, finely powdered, stir it well for two minutes, put in your yarn again, and keep it in two minutes, stirring it all the time; then take it out and put it in clean cold water, in which let it remain two minutes more, then take it out and dry it, after which boil it well in strong soap suds. Cotton and wool may be dyed in the same way, but will not bear boiling in suds more than milk warm.

To make a fine Green.

Pulverize in a mortar equal quantities of verdigris and cream of tartar, to which add eight times its quantity of water; let it remain thus for eight days in a bottle, kept in a moderate heat. This solution is then to be filtered, adding thereto an eighth part of the weight of the verdigris of gum-arabic, keeping it over a gentle stove heat until the gum is dissolved; from this will be obtained a fine green, which will be rendered more clear and deep according to the degree of evaporation.

The process of making PRUSSIAN BLUE *with facts and observations on the theory. By the late* JOHN PENNINGTON, *M. D.*

FEW facts have engaged the attention of chymists more than the theory and preparation of this wonderful paint; it indeed presents us with what is called a *chymical miracle*, that is, two colourless transparent fluids, immediately after mixture, assuming a dark blue colour.

But, before we enter into the theory of the operation, let us attentively consider the process itself, and lay down what we suppose the most economical method of making it. It consists in heating a mixture of certain animal substances, as dried ox blood, bones, horns, and some others, with a fixed alkali [potash] in the manner hereafter described.

It has been found, that almost *any animal* substance may be used for this purpose; but, for a variety of reasons, I would prefer *bones:* they can be procured more conveniently; they require no previous boiling to render them solid, as blood does; and they contain more useful matter in a smaller bulk, which a manufacturer will find to be of no small importance.

One of the chief advantages of a chymical manufactory is, that *nothing is lost.* To procure spirits of hartshorn for medicinal purposes, *bones* are distilled; the bones, after this process, provided they are *black*, are as fit, or perhaps even better, for the

preparation of Prussian blue, than *ox blood*, or even bones themselves, in their fresh state: they are more pulverable, and consequently more easy to be combined with any other substance. They are, in this state, to be procured at a very low price, perhaps for the trouble of hauling them away, as several hundred cart-loads have been thrown away, within a year, near the city of Philadelphia.

I believe that any of our readers, who shall be inclined to make this article, will find the following the *cheapest* and most easy process, and which I can recommend from many actual experiments.

Take six pounds of powdered *black bones;* mix them well with one pound of potash; press them closely into an iron pot, which ought to be covered with an iron cover, well plaistered with clay or earth: let the whole be exposed to a *bright red heat*, during the space of three or four hours. After suffering it to cool, it should be taken out, all its soluble parts dissolved in hot water, and made clear by straining through flannel. If we would wish the blue to be of the very best quality (in which case the quantity will be proportionably less) we pour into this liquor *spirit of salt*, or *oil of vitriol*, until we observe no more boiling, or hissing noise, on the fresh addition of it: we then pour the whole into a solution of only half a pound of green vitriol in two gallons of water. If we wish to have a *lighter blue*, we add a less quantity of the spirit of salt, or oil of vitriol, to the liquor from the bones, in which case we add a quarter of a pound of alum to the solution of the green vitriol; we then mix a little of the two liquors in a phial, and if the colour is too light, we add more of the spirit; if it is to our mind, we mix the whole together as before. In the instant of mixture, the two liquors, which were before *colourless* and transparent, become of an opake blue, darker or lighter, according as the first or second direction has been followed; in a few hours the blue *fecula* subsides, and leaves a transparent liquor on the top, which may be thrown away: the sediment must be stirred up with clean hot water, and then suffered again to subside: this must be re-

peated seven or eight times, and then be filtered through paper and dried on a large cake of chalk. The other part of the process is so *mechanical*, that I am certain it will occur to any experimentalist who shall ever undertake it.

I shall now only hint at some advantages which may be obtained from a manufactory of Prussian blue, in *large quantities.* Bones may be ground with no trouble, and very little expense to the workman, by those who grind the plaster of Paris: large iron pots might be used, and a number of them filling and being filled whilst one or more was calcining in the furnace, a fresh one might be put into it as soon as the other was done, without suffering the fire to go out.

Mr. Macquer, who made many valuable experiments upon this subject, has found that a double elective attraction takes place between the *ley* drawn from the bones, the pot-ash, and the *green vitriol;* and that whilst the alkali tends to unite with the * vitriolic acid of the green vitriol, *a something* united to the ley or alkali, at the same time leaves the alkali, and unites with the earth of iron contained in the green vitriol, which two last ingredients are the proximate or immediate constituent parts of Prussian blue: this something, whatever it may be, certainly gives the colour to the earth of iron, and this he modestly calls the *colouring matter of Prussian blue*, and, from theoretical principles, he supposed this was phlogiston; hence he afterwards called the alkali thus impregnated, the phlogisticated alkali; to this hypothesis, the same ingenious author who framed it, raised some striking objections, but not sufficient in his opinion to overturn it, and having none better to offer, he was inclined to support it.

He extended his experiments still further; he proved that vegetable alkali, boiled with Prussian blue, was able to *attract* the colouring matter from it, and thus to decompose it, making an artificial *phlogisticated* alkali; whilst the calx or earth of iron,

* We will just repeat here, that copperas (also called green vitriol) is a compound of vitriolic acid and iron.

in the Prussian blue, remained like *rust* in the vessel; by adding to this new mixture some green vitriol, he was able to *regenerate* a very pure Prussian blue, upon the same principles as already explained.

We are told, by Mr. Fourcroy, that a Mr. Sage presented a memoir to a certain literary society, on the phlogisticated alkali, in which he supposes it consists of a fixed alkali and *phosphoric acid:* before we proceed further, I will just mention that many animal substances contain a certain acid, which, treated in a particular manner, yields a substance capable of burning when only exposed to the air, and this is called phosphorus, and the acid capable of yielding it, is properly enough called phosphoric acid. But Mr. Sage is not altogether accurate in his remarks on this subject; we have now in this city such a salt, consisting of a fixed alkali and this acid, called *soda phosphorata;* but a solution of this salt, added to a solution of green vitriol, will not yield a *blue*, but a *white* colour; and we conclude, with the abovementioned author, that his theory cannot be admitted.

Messrs. Bergman and Scheele, in a variety of most beautiful experiments, to which I refer the curious reader, have proved that this colouring matter is an *acid*, and consequently that the *phlogisticated* alkali is a neutral salt, consisting of a fixed alkali and the acid which he with great propriety calls the acid of Prussian blue. Mr. Bergman conjectures that the acid is composed of aerial acid, (fixed air) volatile alkali, and phlogiston; but I shall venture to offer my doubts on this head.

In the preparation of Prussian blue, we find that every substance, containing *phosphoric acid* and volatile alkali, and is capable of burning, or (as a theorist would express it) that contains phlogiston, are proper for the purpose. I have not been able to find any *animal* matter that had not the first and last substances in its composition, that could be made to yield Prussian blue, and experiments seem to show that the *volatile alkali* is *not* essential to success. *Ox bile*, according to Fourcroy, distilled in Woulfe's apparatus, yields *concrete volatile alkali* (the salt formed by aerial acid and pure volatile alkali) and inflammable air

(the phlogiston of Bergman) with a considerable quantity of uncombined aerial acid, which Fourcroy always calls *cretaceous* acid. Here then we find all the principles which Bergman supposes to be necessary to make his *Prussian acid*, but I believe every chymist will fall short of success, if he substitutes *ox bile* for dried blood, &c. in his process for making Prussian blue. I have twice attempted it, but in vain: and in further confirmation of the uncertainty of this method, we remark, that if ox bile is dried first, and treated in the way that is necessary to obtain phosphoric acid from other animal matters which yield it; yet it will not afford one particle of it.

THE following account is extracted from the *Journal de Physique*:

" Any quantity of horns and hoofs is to be mixed with an equal weight of chippings of leather, and the whole submitted to distillation in a large iron retort, fixed in a reverberatory furnace; the oil and impure ammonia, resulting from this process, are collected in a receiver, and the distillation is carried on at a high heat, till no fluid or vapours of any kind come over—the oil and alkali are disposed of to different manufacturers, and the black spongy coal remaining in the retort is the only part made use of in the preparation of the Prussian blue.

Ten pounds of this coal, and thirty pounds of common potash, are reduced together to a coarse powder, and heated to redness in an iron pot; by degrees the mass is brought into a state of semifusion, in which it is suffered to continue twelve hours, when the matter gives out a strong odour of sulphur; it is then taken out red hot, and thrown into a boiler of water, where it undergoes ebullition for about half an hour. The clear liquor is separated by filtration, and the residue is boiled in fresh parcels of water, till all the saline matter is extracted. These different lixiviums are then mixed together. Four pounds of alum, and one

and a half of green vitriol, are dissolved in warm water, and this solution is added to the former: a copious whitish precipitate is immediately deposited, which being collected and washed, acquires, by an exposure to the air, a beautiful blue colour."

A method, differing in some small degree from the above, is practised in some of the manufactories.

Six pounds of clippings of leather, six pounds of hoofs and horns, and ten pounds of common potash, are boiled together in an iron pot to dryness; the residue is then mixed with two pounds of crude tartar, and by means of a strong fire, brought into fusion. The lixiviation is conducted in the usual way, and a solution of five pounds of green vitriol, and fifteen of alum being added, a precipitate takes place, which is the Prussian blue.

REMARKS.

The foregoing essay by Dr. Pennington, is taken from a volume now very scarce, of "*Chemical and Economical Essays*," published in the year 1790 in Philadelphia, while the author was a student of medicine; and whose death, which took place in 1793, will never cease to be a source of regret to those who knew his chemical talents, his industry, and the useful bent of his pursuits. The foregoing paper is the result of numerous laborious experiments, and has therefore a strong claim to the attention of the manufacturer of the article of which it treats.

The Editor, anxious to discover whether any improvement had been made on the manufacture since the publication of Dr. P.'s essay, consulted Aikin's Chemical Dictionary; but was surprised to find, that after giving the process as first published by Macquer, says that "This with some variations in the proportions of the ingredients and in the exact manipulation, is said to be the usual way of preparing this pigment in manufacture, and will always succeed to a certain degree. Nevertheless several chemists who have exactly followed it in the large way, for the purpose of sale, have been disappointed in the quantity yielded, and have not always succeeded in the quality of the article, so that

it is probable that there are some particulars in the manipulation, &c. which are only known to the manufacturers."

Mr. Nicholson, who is usually so particular in his notices of the arts, is even less instructive on the subject. See his Chemical Dictionary.

ON MAKING EARTHEN-WARE.

(From Parkes's Chemical Catechism.)

EARTHEN-WARE, according to the Old Testament, was known at an early period to the Jews; and the potter's wheel, there spoken of, was probably the same simple machine as is used at the present day to form round vessels with plain surfaces. The making of porcelain has long been known in China and Japan; but it was accidentally discovered in Europe by a chemist, in the beginning of the 18th century. It was so esteemed by the Romans, that, after the taking of Alexandria, a porcelain vessel was the only part of the spoil retained by Augustus. Dr. Thomson, vol. ii. 286.

For making pottery, or earthen-ware, the clay is beaten in water; by which the fine parts are suspended in the fluid, while the coarser sink to the bottom of the vessel. The thick liquid is further purified by passing it through hair and lawn sieves of different degrees of fineness; and is afterwards mixed with another liquor of about the same density, consisting of ground flints. This was the composition of the white stone ware, about 40 years ago the staple manufacture of the potteries of this kingdom; and it is also that of the finer earthen-wares at present in use, though in different proportions; and with various improvments, introduced by the ingenuity of succeeding manufacturers. This mixture is then dried in a kiln, and after being beaten to a proper consistence, becomes fit for being formed by the workman into dishes, plates, bowls, &c. The fine white and cream-colour earthen-wares now made in England are fired twice: the first time to give them the requisite hardness; and in that state they are called *biscuit:* they are then dipped in a vitreous composition, and being sub-

jected to a second burning, acquire a coating of true glass, thence called a *glaze*. If they are finished with painting in enamel, it is necessary to pass them a third time through the fire. One of the ingredients of this glass being oxide of lead, the workman, whose hands are constantly immersing in the mixture, is subject to *paralysis*, unless due precaution be taken. To prevent it, the manufacturers have of late years assigned to such men a varied employment about their ovens, and furnish them with a dress to wear at the glazing tub, and throw off when they leave it, and a water cistern, soap, and towels near them, that they may be more certain, when employed in the glazing, to wash their hands before they go to their meals. It is feared, however, that an unhappy opinion of the efficacy of spirituous liquors does more mischief to this class of workmen than any other circumstance; for, attributing to the effect of lead whatever slight disorder occurs, they have recourse, in the first instance, to them as specifics, in such cases, and thus acquire the habit of an immoderate use of what probably affords them a temporary relief, but does not fail to produce a permanent and destructive disease. This is, I believe, the sole opprobrium which falls upon the potter's art, yet even this may be greatly diminished, if not entirely removed, by the precautions above mentioned: however, as it is desirable to preclude the use of lead altogether, the Society for the Promotion of the Arts has offered a premium for a substitute for this glaze, or for a mode of using it which would not subject the men to these dangers.

The white and the brown stone wares are passed only once through the fire, for at a certain period of the heat they are made to undergo a partial vitrification at the surface, by the fumes of muriate of soda; this salt being thrown into the oven, and the pieces of ware so disposed as to receive the fumes of it on every part of their surfaces. This method of glazing earthen-ware with salt was introduced into England by two brothers from Holland, of the name of Elers, about the year 1700. They settled in the neighbourhood of the Staffordshire potteries; and it is remarkable, that the alarm occasioned by the fumes which spread over the country obliged them to leave it. The son of one of these artists

was afterwards an active magistrate of the county of Oxford; and *his* son is at present a very respectable English barrister. A similar manufactory was however soon after established, at Shelton, in the potteries, by one of their workmen, named Astbury, who had possessed himself of their secret; and as it became of great utility, it was readily tolerated by the inhabitants, and at length, on the common day of glazing, (Saturday,) the thick offensive fumes from fifty to sixty manufactories filled the valleys, and covered the hills of a district of country, extending many miles.

There is no doubt that the potteries had been established in this part of Staffordshire, which abounds with coal, for many centuries: at some depth indeed below the surface strong indications have been found of the site of Roman potteries; but down to the epoch I have been speaking of, the productions and the condition of the potters were in much the same rude state as when Plot made his survey of the county.

The Messrs. Elers had also the merit of introducing into this country a red unglazed porcelain, which they made from a clay found in the estate they had settled upon in Staffordshire, called Bradwall; but it was only the brown stone ware, (of the same kind as that now made by the Lambeth potters,) in the composition of which no flint is used, which they glazed in the manner above described. The white stone ware, and the use of ground flints in the pottery, were discoveries of later years; and owe their origin to the following curious incident:—About the year 1720 a potter (believed to be the Astbury above mentioned) travelling to London on horseback, had occasion, at Dunstable, to seek a remedy for a disorder in his horse's eyes; and the ostler of the inn, by burning a flint stone reduced it to a fine powder, which he blew into them. The potter, observing the beautiful white colour of the flint after calcination, instantly conceived the uses to which it might be applied in his art; and then introducing into use the white pipe-clays found in the north side of Devonshire, instead of the irony clays of his own county, he readily produced the white stone ware. At first the flints were reduced to powder to the great injury of the persons employed; but the

immortal Brindley, in the early part of his life constructed the mills that are at present in use for grinding them in a moist state."

About the year 1750 commenced the inventions and improvements of the late Mr. Wedgwood, who, by combining science with the art, and having the advantage of a highly cultivated taste, not only greatly extended the uses of English pottery, and turned the tables upon the French and Dutch, who had hitherto exclusively supplied Europe with fine earthen-wares, but rendered it an object of admiration, and deserving a rank among the fine arts of the age. This inestimable man has left us an admirable example of what may be effected by cultivated talents and persevering industry. Such investigations as those to which he was accustomed, bring with them their own reward. Such experimentalists

> "Exult in joys to grosser minds unknown,
> " A wealth exhaustless, and a world their own."

Porcelain is an artificial compound of great durability. When good, it is of so campact a texture that it would probably endure for ages. There is an octagon tower at Nan-king in China, called the Porcelain Tower, which is entirely covered with the most beautiful china. It is a building of nine stories, nearly 300 feet high, and each story decreases in breadth, as it rises in height. This singular and elegant edifice still retains its original beauty, though it has sustained the continued action of the sun and weather for four hundred years.

An interesting account of the processes which are carried on in the great French manufactory of porcelain at Sevres, has been published by Brongniart, who superintends it. See Philosophical Magazine, vol. xiii. xiv.

The Chinese are said to let their clay remain exposed to the atmosphere at least 20 years before they use it in making porcelain. Some tile-makers in England, who are curious in the article they manufacture, never use their clay till it has lain a year or two in the open air.

It is probable that some of the most esteemed of the porcelain clays may owe their estimable properties to an admixture of mag-

nesia. In Nicholson's Journal, vol. xii. we read of a porcelain earth, hitherto considered pure clay, having been analysed, and found to consist only of carbonate of magnesia and silex. Magnesia, I understand, is of use in porcelain, by lessening the degree of contraction to which all kinds of earthen-ware and porcelain are liable.

The beautiful colours, which are seen upon porcelain, and earthen-ware, are given by metallic oxides. Purple is given by gold; red by the oxide of iron; yellow by the oxide of silver; green by copper; blue by cobalt; and violet by manganese.

In another part, Mr. Parkes informs us, should pure silex be wanted for chemical experiment, it may be procured by fusing common flint stones with three or four times their weight of potash, dissolving the product in water, and then taking up the alkali by the addition of an acid, which will precipitate the silex, which is to be well washed for use. The siliceous stones should be previously heated red in a crucible, and plunged in that state into cold water. This will render them brittle, so that they may easily be reduced to powder before they are mixed with potash.

HISTORY OF THE INTRODUCTION OF THE MANUFACTORY OF ALUM INTO ENGLAND.*

TOWARDS the latter end of Queen Elizabeth's reign, a discovery was made of the utmost importance to Whitby, and the country which surrounds it; it was to find that the coast there, every where abounded with alum rock. Thomas Chaloner, Esq., afterwards Sir Thomas Chaloner of Guisborough, being upon his travels, and in Italy, carefully examined the Pope's alum works, near Rome, which were then the only manufactories of that article in Europe, and were very beneficial to his holiness, bringing him in yearly a very large revenue. Mr. Chaloner recollected there was a mineral exactly of the same kind, in the neighbourhood of Guisborough, and was very desirous to try if erecting an

* From the Tradesman, or Commercial Magazine—April, 1802.

alum work there, would not greatly advance the income of the Chaloner family. But as he was entirely a stranger to the process, he found it would be absolutely necessary to procure some artists well acquainted with the whole mystery. These he knew were no where else to be had but from the Pope's alum works; for which reason he tampered with some men of ingenuity who were employed there, and partly with money, and partly with promises of large rewards, engaged two or three of them to come over with him to England. But as a discovery of his design would infallibly have subjected him to capital punishment in the Pope's dominions, for the preserving of secrecy, he had them packed up in large casks, and in that manner clandestinely conveyed them on board a ship, then ready to sail for England. With this acquisition, getting safely off, he made the best of his way for Yorkshire; and immediately after his arrival, began to erect an alum work, very near his own habitation, which afterwards completely answered his expectation, and brought him in yearly a very large revenue.

The Holy Father when informed of all these proceedings, was extremely provoked, and some considerable time after their leaving Italy, thundered out a dreadful curse against Mr. Chaloner, and the journeymen alum-makers who had eloped with him. This curse from the then head of the Christian Church, though every line of it breathed revenge, and every clause of it was for the everlasting damnation of the poor alum-makers, had not the effect for which it was intended; it hindered not Mr. Chaloner and the workmen who were with him, from making alum; it neither struck their minds with idiotism, nor their limbs with palsy; it neither extinguished their furnace fires, nor overturned their boilers. But this it did; it discovered to the Christian world, how heartily and sincerely the holy successor of holy Peter, was able to curse and to swear; and how he could bellow out those curses in the names of the most holy Trinity, the mother of God, and all the holy angels, saints, confessors, and martyrs! And what was all this congregation of

Powers and dominions, seraphims and thrones to effect?

Why truly to assist his holiness in a commercial monopoly! To break up an English alum manufactory! To annihilate a brother tradesman!

Tantæne animis cœlestibus iræ?

It is sometimes said that two of a trade cannot agree; perhaps this proverb, which like many other proverbs, took its rise in the times of ignorance and presumption, originated in the curses of this successor of St. Peter!

But let us turn a moment from the curses of this proud priest, to contemplate a useful subject. Mr. Chaloner, and the workmen who curst not at all, proceeded in the manufactory, which flourished like a tree by the river side. The price of this article was of consequence considerably reduced. Mr. Chaloner got money so fast (in despite of the curses and pride of that theologian,) that it excited the emulation of several neighbouring gentlemen, who were very desirous of sharing in so beneficial a trade. Thus it seems the curses of the Pope, like the blood of the martyrs, which our popish Queen bade to burst from their veins in the horrors of the stake, only spread the benefits which these religionists wished to blast; but as there was little hopes of Mr. Chaloner admitting them into partnership, the Darcy family, after the year 1600, began to erect a second alum work, not far from that of Mr. Chaloner's; this also brought so much gain to its owners, that about 1615, another was formed near Land End, within three miles of Whitby, whose profits were so great, that it still further excited others to venture, and in consequence, this business was established on a foundation not to be overturned; it was, as if built upon a rock.

But here the advantages of this new manufactory did not stop; it was necessary that large quantities of coal should be procured, an article then but little known in that coast; these they procured from Newcastle and Sunderland, and to secure this connexion, a design was formed to have vessels always in readiness to go to sea in moderate weather. Some of the fishermen offered their services for this work, and then vessels of burden, about 1615 began the trade with Newcastle; they afterwards ventured to

London with alum, fresh butter, &c. and returned laden with merchandise, which was sold at Whitby with considerable advantage; and then also began the coasting trade, the ships employed in which, did not carry alum.

IVORY BLACK.

Specification of the Patent granted to William Docksey, of the city and county of Bristol, millright; for considerable improvements in the Process of manufacturing Ivory Black; and for pulverizing, grinding, or reducing to a subtle and fine Powder, all articles capable of a more easy separation of their parts or constituent principles by torrefaction, heating, or calcination, in open or close kilns, ovens, or furnaces, especially potters clays, flints, colouring and glazing materials.

Dated May 22, 1810.

TO all to whom these presents shall come, &c. Now KNOW YE, that in compliance with the said proviso, I the said William Docksey do hereby declare, that my said invention is fully described and ascertained in manner following; that is to say: My invention consists in manufacturing ivory black, and all articles capable of an easy separation of their parts or constituent principles by torrefaction, heating, or calcination, such as potters clays, flints, colouring and glazing materials, with a very small quantity of water, in grinding or reducing the said articles to fine powder; by which means or process much machinery and labour employed in the processes now used in manufacturing the said articles with a large portion of water are avoided, and the stoves employed to heat the rooms or other places for evaporating the water used in the processes now practised rendered unnecessary, and which processes of drying ivory black greatly hurt and impair its colour.

In order that my several improvements may be clearly understood, I shall proceed to detail my processes more particularly, premising, that I do not mean to confine myself to the exact machinery and processes here described, in which divers variations may be made, as my invention depends on grinding or reducing

the several articles above mentioned to subtle powder, by omitting to use any considerable quantity of water.

First. To manufacture ivory black, I take the bones and sloughs of the horns of animals, and calcine them to blackness, in close or air-tight vessels. I then crush them in their dry state, between metal rollers, of about two feet diameter, until they are broken sufficiently small to pass through a hopper into the eye of a mill-stone, and be reduced to powder between mill-stones, in an horizontal situation, exactly similar to the method of reducing or grinding corn or grain to flour. By a like process, the powder thus obtained is then partly passed through a dressing machine, constructed with brushes and fine iron or brass wire, upon a circular frame, inclosed within a rim, which receives it. Such part as passes through the meshes of the wire (which should be about sixty-eight to an inch) is sufficiently fine for use, and is damped down by a small quantity of water sprinkled upon it, and packed for sale; the coarser part is returned to the hopper, and ground over again between the stones.

Secondly. In respect to the flints, potters clays, and colouring and glazing materials, my method is to take calcined flints, dried clays, calcined lead and lead ores, manganese, or whatever article is proper for glazing, and pass it under stampers or heavy hammers, to break or bruise it in small pieces, sufficiently small to pass between metal rollers, where it is crushed so fine as to be reduced to a pulverulent state; it is then ground in its dry state between mill-stones, in a manner similar to that before described for manufacturing ivory black. It is then passed through a dressing machine (inclosed within a very tight and close binn, which receives it); the coarser parts being thus separated, the finer parts are then mixed with water in a tub or deep vessel. The coarser parts are farther separated by subsidence, and the finer and thinner parts passed through a fine lawn or cypress sieve; the water is then drained off, and evaporated by heat from the substance, and the powder thus obtained is of a superior kind of fineness.

In witness whereof, &c.

REPORT, IN PART,

Of the Committee appointed to ascertain the number of persons employed in, and to inquire into the state and condition of the Patent-Office.

THE Committee first remark, that they accord with an opinion expressed in a letter to them by the Secretary of State, that "every institution ought to be comprised with some one of the departments of government," and offer for the consideration of the legislature, the propriety of authorising a new department, to be called the "*Home Department.*" They then proceed,

The gross amount of fees received from the commencement of the establishment to the 31st of December, 1811, is $ 48,110; of the sums received after deducting the amount paid for salaries to a clerk, and the monies necessarily expended for parchment, stationary, printing, fuel, &c. there remains a balance of $ 25, 379.34 in the treasury of the United States, applicable to useful purposes connected with this institution. The statement demonstrates that the amount annually received for patents issued has increased every succeeding year, and that in the year 1811 it amounted to $ 6,810 dollars; from these facts your committee augur favourably as to the future; the office has done much more than to support itself; the fund thus created, if properly managed and applied, may hereafter give rise to many valuable institutions in our country. A *school of arts* may be organized by the legislature, which will require no other pecuniary aid than will be contributed by the industrious, the ingenious, and the useful citizens of the United States.

It may be well to ask, what is the design of a *depot* of the models for which patents are granted? Idle curiosity alone cannot have induced the wisest governments to take them under their special charge. If useful results had not been the consequence of such establishments, they would long since have been abandoned. In Europe experience has developed the numerous benefits which are derived from this source every year. In the subsequent part of this report your committee persuade themselves they will lay before the legislature such details and facts connected with our

country, as will characterise the institution "a register of human industry and ingenuity." They anticipate the period when this *depot* will constitute the basis of a *school of arts*, from whence shall emanate every class of useful citizens. In this school all children may be taught some useful trade; to the end, that none may be idle, but the poor may work, and the rich, if they become poor, may not want.

Your committee made a visit to the present establishment. For its various purposes the west wing of the second floor of the building, heretofore denominated Blodget's Hotel, is allotted to the models. This portion of the building consists of four apartments; one of which is 56 feet by 39 feet; another 39 feet by 22 feet; the remaining two rooms 22 feet by 12 feet each, with ceilings well adapted for the purpose. Your committee propose that the two first mentioned rooms shall be appropriated *solely* for the placing and exhibiting of models; one of the smaller rooms to be occupied as an office by those who conduct the institution, and the other to be used for a library, to be formed of such books as may be deposited to secure the copy right, for charts, &c.

The apartments are at this time in an unfinished state. Workmen are employed to complete them; a sufficient appropriation for this purpose has been already made by congress.

Many models are already deposited. The manner in which they are placed tends to confusion, and to sink the establishment into contempt. All is chaos. The machines are out of repair and so intermixed as to make them almost useless. Useful machines are thus kept from view, and for the want of a proper catalogue containing a general description of the models, they are not understood. By such means the most beautiful inventions have been brought to ridicule. The despatch, safety and success of business is promoted by nothing so much as method and regularity. Every visitor ought to be able to derive benefit from this *depot;* this can only happen where method is attended to. The subjects of this establishment admit of *classification* according to fixed and established principles. All the apparatus used in distillation, the machines for cutting nails, for cutting files, for gin-

ning, carding, roving, drawing, spinning, weaving, &c. should be contiguous to each other, and arranged according to the date of the patent. Placed in this manner there would be a mass of knowledge embodied before the spectator; the arts would be easily traced, the machines would thus be advertised as it were, and every one would go away much more informed than when they went into these apartments. The present prevalent confusion in some degree depends upon circumstances. When the machines were formerly deposited near the department of state, the room was much too limited; the machines were heaped together, and many of them were deranged in their several parts. The unfinished state of the present building will keep the models for a further time in a state of irregularity; it is to be hoped that habit will not operate to make this perpetual. Success in this institution depends much upon the competency of the person or persons who are to conduct it. They should be liberal in all their views, no wise ambitious to become patentees themselves; no jealousies should exist between them and inventors. To the latter every facility should be offered and every aid given; because, often they are men of limited knowledge and need the assistance of others in their specifications, &c. Under such guidance the institution will be promoted, and useful knowledge diffused throughout our extensive country.

To impose upon ourselves the task of proving the utility of this institution, may to many appear idle and unnecessary. We have determined on the inquiry, and solicit your indulgence on the subject. By the acts which congress have passed relative to patents, it is indirectly provided, that such a *depot* shall be formed. In the United States no patent can issue to guarantee *a mere principle;* it "must be for the vendible matter:" hence the necessity of a *conservatory* to prove the facts in disputed cases. The act further requires models to be *deposited* in such cases as the secretary of state shall deem necessary. The arts have ever been patronized and protected by civilized nations: the ancient *republics* bestowed much upon the fine arts. At this time our object should be to promote those which are termed *useful.* Though

we cannot but admire the taste and genius of a Pericles or a Phidias, we deem it more consistent with the state of society and manners in the United States, to mark with distinguished honours an Arkwright, a Bolton, a Watt, a Wedgewood, a Whitney, a Fulton, a Whittemore, an Evans, and a host of others who compose the class of benefactors of the human race. Their inventions not only astonish and confound by the intricacy of their structure and the delicacy of their execution....they do more; they enrich a people and constitute the formidable pillars of national independence. Useful machinery excite human industry; circulate capital; expand the wings of commerce, and carry us to the remotest regions of the habitable world. The progress of the arts and civilization, keep pace with each other. The arts are favourable to civil liberty: they alone give rise to internal improvements; and that nation is of all others the most certain of prosperty, by which these principles are well understood and put into practice. America cherishes peace. Circumstances may force her into a war. Even in that state of things her arts will achieve more lasting advantages for her, than did the conquests of an Alexander, a Cæsar, or a Zengis Khan!

Useful inventions of machines are more particularly necessary at this time in the United States, when much may depend upon our manufactures. All labour-saving machines add so much to our population. We do not dread that riot and famine will follow the introduction of such agents into our workshops: we should do all in our power to encourage their importation from abroad. In this respect England is an example worthy of imitation. Whilst tyranny and oppression, from mistaken notions of policy, were operating with an iron hand upon the industrious in Flanders and France, England did all in her power to invite their emigration; every encouragement was given to them, and many advantages were offered. By such means did she establish her power and wealth; which, at this time is gigantic, and threatens neutrals and herself with annihilation from its misapplication. Our inventions keep pace with our necessities. It is not long since we dreaded the want of blankets. American genius has suggested a simple

method by which a single workman can furnish twelve per diem. Almost every department of the mechanical arts was languishing for the want of *files*. Several machines have been lately invented for cutting these highly useful instruments. With one of them a single workman may make several hundred files per day, which may be sold at prices much below the imported! Who, with a knowledge of facts like these, can deny protection and security to the useful arts? Such inventions will do more for the nation than can be effected with armies and fleets. It is certain fleets and armies cannot be supported without them.

We shall now give a short historical sketch of the subject in Europe, and then trace its progress in the United States. Two centuries have elapsed since Henry the IV. of France, conceived the great design of a *conservatory* of models of whatever was curious or useful in machinery, "that all those (to use the language of Sully) who aspired to perfection, might improve themselves without trouble, in this silent school." The death of Henry put a stop to the execution of this scheme: in it he was followed by other monarchs, and by none with more zeal than those of France. In modern times, we may refer even to the dark pages of *revolutionary* France for many proofs of the devotion of that nation to this highly useful branch of knowledge; and at the present period the useful arts are well understood and cultivated with much success throughout that empire: liberal rewards are offered by that government for such inventions as may prove of national benefit. The enormous sum of $ 183,332 is offered as a premium for a machine which will prepare and spin *flax*, in as perfect a manner as is done with *cotton*: the ingenious of all nations are invited to become competitors for this prize. The emperor has taken this department under his own direction, and no patent is granted "without a special decree from Napoleon." This arrangement gives consequence to the establishment. Not content to stop here, a professor is appointed *especially* to deliver lectures on machines: he discourses on the models generally, and at stated periods accompanies his pupils to observe the machines in the different workshops of Paris and its vicinity; the operations of

the various manufactures are demonstrated, and a general discussion of all the principles which are connected with the useful arts, is entered into and exemplified by practice. This institution furnishes, annually, a considerable number of useful members of society. In the establishment just alluded to, persons are employed, whose duty it is to form models of all such valuable machines as are deposited; these are on a regular scale and accurate in the proportions of the several parts, so that the model will move correctly and produce effects proportioned to its size: machines may be made from these of any dimensions. In France, schools for instruction in every art and science are diffused throughout the empire; no useful branch is neglected: the teachers are very numerous, and each institution has a fixed number of pupils, who are supported at the expense of the government; they are taught to arrange, plan and execute all the operations which can be of use to the nation. In cases of emergency that empire may draw upon this capital stock for useful men of every description, whether it be in philosophy, the various mechanical arts, the military art, &c. &c. If the United States were equally prepared at this momentous period, much expense would have been saved to the nation, and much trouble to the government. We repeat it, a *school of arts* is essentially necessary to our country. In the German schools they have professors, whose duties are like to those in France. At Gottengen, professor Beekman, the author of three volumes of the history of discoveries and inventions, was employed. In England, in the royal institution, they take a proper notice of this subject, and no one has ever visited the *depot* of models at the *Adelphi*, without much pleasure and instruction. In Britain, where great distinctions are made in society, many persons occupy themselves with the useful arts, whose rank would seem to forbid it: and several noblemen of distinction have patented useful inventions. If then all other nations deem it wise and essential to bestow favours in this way, shall it be said that in the territories of the only free republic of modern times the arts were ridiculed and neglected? This can never be the case with those who understand the true interests of the state; the national genius

forbids it, and nothing can stifle this *infant Hercules* of the United States. No nation can boast of more useful inventions than those of the people of the United States. We might bring to recollection many, which alone could have resulted from the exercise of genius of a superior order. *Rittenhouse* contrived and set a world in motion. *Whitney* furnished us with a simple machine by which the people of a world are enriched, and made happy!

In obedience to resolutions passed by the house of representatives of the United States, the secretary of state has reported, that from the 31st day of July, 1790, when the first patent issued from the office, to the 31st day of December, 1811, inclusive, one thousand six hundred and thirteen patents have been granted; of these 215 were for inventions patented in the year 1811; during the present year (May, 1812) 121 patents have been already delivered; 20 are in preparation, and 20 more are suspended for the want of proper and suitable specifications. For several years past, the number has increased annually, and an annual report of them has been directed to be made to congress. This review of the progress of the arts, is highly gratifying to us as citizens of the United States. We now see them flourish in situations where the footsteps of the savage have been scarcely obliterated by the busy scenes of civilized society. Establishments are multiplying in all directions. Nothing but time and proper encouragement are wanting to bring them to perfection. Superficial observers and persons who are not accustomed to study, are apt to treat this subject lightly, and sink it into contempt: they undervalue inventions of every kind, and consider them more the results of chance than of mighty conceptions, and painful thought. The sight of a *steam engine* in motion, must convince the intelligent observer, that the conception which gave rise to this stupendous monument of human invention, is too vast for ordinary comprehension. Persons thus disposed know little of the human mind: experience has not taught them the evils resulting from restless nights and the many disappointments which await projectors; they often exclaim, what necessity or justice in granting rewards for discoveries? They say it cost nothing to effect

the object. Such persons hsve minds too limited to conceive a brilliant idea, too callous to receive a delicate impression, and a heart too cold to reward original genius. It is a habit with some to despise the knowledge of others. In answer to these declaimers we will offer the remarks of Burgh: he says, when treating of projects and schemes, "there is not one of a hundred that ever succeeds at all; nor one of many hundreds that brings to their inventors any thing but disappointment and ruin. So that we observe accordingly, whoever projects any thing new in science, in mechanics, or in trade, seldom does more than open the way for others to profit by his ingenuity." Notwithstanding experience has proved these statements beyond contradiction, many deny to inventors ordinary justice. They do not require of you to yield your privileges or property to them; they request of you simply *to do as you would be done by*, and only to confirm them in that, which has already been made theirs, by the sacred decrees of the Great Creator of the universe. Too often do persons take advantage of the inventions of others and deny them compensation; they are considered as common property. It is with difficulty that the case is brought to a decision before a court of justice, and not unfrequently the inexpediency of awarding in favour of the plaintiff is to well maintained by a jury of *interested* persons: our court records furnish too many instances of this kind. It becomes us to guard against them in future, by a modification of the statute of the United States, which shall *unequivocally* secure to inventors their discoveries and inventions.

Before the adoption of the present constitution of the United States, the several states, as sovereign powers, granted patents. The framers of the constitution deemed this an object worthy their protection; and amongst the powers *delegated* by them to congress, we find that "to promote the progress of science and the useful arts, by securing for limited times to authors and inventors, the exclusive right to their respective writings and discoveries." Congress, pursuant to the recited constitutional provision, enacted a law on the subject, February 21st, 1793; another April 17th, 1800, and during their present session these several

acts are under consideration, to be revised and amended according as experience may have made it necessary. By these acts, the fees which are directed to be paid by the *patentee* are inconsiderable.....not one fifteenth of the amount which is paid in Great Britain. It never was contemplated to derive a revenue from this source. The original intention was to make the amount received sufficient to cover the expenses of the institution. The statements herewith exhibited, prove that a *surplus fund* has accumulated in the treasury, applicable to such purposes as the legislature shall direct.

We do not hesitate to acknowledge that patents have often issued for inventions apparently trivial and ridiculous. On this ground many object to the institution. Reflection will remove this difficulty. The patent costs the state nothing, and from trifling causes wonderful consequences have ensued. *Newton*, from observing the falling of a *pear*, deduced his brilliant theory of *gravitation;* and no year passes in which the principle, inherent in a trifling machine, does not give rise to many valuable applications. You cannot limit in this respect; the constitution guarantees to every one his original inventions, and no harm can result from this practice; the patentee can alone be disappointed in his expectations; no one will purchase that which he deems useless, and a very few, indeed, speculate so far as to give premiums for inventions without having previously seen their promised advantages demonstrated by practice. England sets a high value on objects of this kind....she encourages the introduction from abroad of every useful machine, and she prohibits, under heavy penalties, the exportation of such as are useful in her manufactories. In the year 1774, an act was passed "to prevent the exportation of utensils employed in the cotton manufacture." In England, any person going from Great Britain, and who carries with him the tools and instruments of any useful art or manufacture peculiar to his native country, "must be deemed a traitor."

We can defend this branch of knowledge upon the ground of an enlarged and wise policy: our supplies of clothing and other articles have been generally derived from British manufactures;

that nation has made us tributary to her work-shops, in common with the rest of mankind. This system has been carried so far as to affect the independence of the United States. We may soon be engaged in a war with that power. Propriety and necessity combine to carry us into other channels. We need not leave our shores for this purpose. Unlike Great Britain, our agriculture furnishes us more food than we can consume, and yields us the raw materials from which *that most dependent of nations* has been heretofore supplied. We only need labour-saving machines to form these into the fabrics which habit, comfort and fashion have made necessary in civilized society. Some say this is impossible; they do not know that the greatest changes in this way have taken place in England within the last thirty years! A revolution is at this time about to take place, by which all nations will free themselves from the shackles which heretofore bound them to Great Britain, and allowed them but a nominal independence. This revolution can alone be perfected by the agency of the useful arts. Great Britain is dependent upon foreign nations for eight-tenths of the raw materials which are used in her manufactories, and the few which she derives from her internal resources are forbid to be exported. As an indulgence in this respect, in the year 1777, it was enacted by parliament, to permit "the exportation of tobacco-pipe clay," it being necessary to the sugar-makers in the West Indies. All American trade has concentred in England; whether it be to the Mediterranean, the Euxine or the Baltic. Thus have we contributed much to the support of British fleets and armies for many years past. The great pressure occasioned by the enormous national debt of Great Britain, and the increase of the annual taxes, may cause distress, turbulence, riot and bankruptcy; even a change of the present *dynasty* may be the consequence....all these circumstances combined will not effect the reduction of that *gigantic* power. Changes like these, experience has proved, are only changes of men in power; the nation still remains compounded of the same great mass, with her capital and skill undiminished, which, by a judicious system of reform, will secure to her power and wealth. England can only be seriously

affected by striking a severe blow at the roots of her industry, the great base upon which her security is founded. A war against Great Britain will be inefficient, if carried on solely by your armies and fleets. By paralyzing her arts and manufactures, you destroy her vitals; the heart will be seized by a canker which will render the extremities inefficient and useless.

The effects and benefits in a national view, resulting from the introduction of useful labour-saving machines, may be traced and demonstrated in the rise and progress of the British cotton manufacture. Not longer ago than the year 1755, the cotton manufacture in England was considered "amongst the humblest of the domestic arts;" the products were chiefly for home consumption. Machinery in this branch was then unknown. In the year 1750, twenty thousand persons only were employed in this way....little progress was made for several succeeding years. In the year 1806 they declared, "*there is scarcely a civilized nation on the earth that is not indebted to us for some article of this manufacture.*" Some Manchester manufacturers have furnished as many as two thousand different varieties of patterns on their cards, for the continent of Europe.

In the year 1705, not more than 1,170,881 lbs. of cotton wool was imported into England. In the year 1781 it amounted to 5,101,920 lbs., in 1810 to the enormous and incredible quantity of 135,000,000 lbs. This last fact we state upon the authority of Sir Robert Peel, the most extensive cotton manufacturer in Great Britain.

In the year 1797, the cotton branch took the lead in the manufactures of Great Britain, and continued to advance until the American and continental markets, from motives of policy, were shut against them. In the year 1809, it was calculated that this branch of industry in Great Britain gave employment to 800,000 persons, and that the annual value thereof, amounted to £30,000,000 sterling, or $132,000,000! The United States for many years, received more manufactured articles from Great Britain than the whole of Europe taken together. The following

statements are given from sir F. M. Eden's letters on British manufactures and commerce:

Years.	Exports to foreign Europe.	Exports to U. States.
1795,	£4,222,782	£4,892,572
1796,	4,497,683	5,835,640
1797,	3,732,830	4,871,316
1798,	3,981,650	5,313,068
1799,	4,543,608	6,696,221*

England has no advantages peculiar to herself. The introduction of useful machines gave her pre-eminence. Machinery enabled the people of England to sell their manufactured articles at reduced prices, and to undersell all other nations. In the year 1762, *cylinder* cards were first made use of by Mr. Peel. In the year 1767, James Hargrave made the first great improvement in the spinning of cotton by means of machinery, and Arkwright's first patent for spinning cotton by means of rollers, was obtained in 1769. The machine was put in motion by the application of horse power; in 1771 water was employed, and *now* that of *steam* is in general use. Improvements in this art have been carried so far "that a pound of fine cotton has been spun on the mule into 350 hanks, each hank measuring 840 yards, and forming together a thread 167 miles in length!" A single pound of cot-

* Nominal or current value of Exports from Great Britain to the United States, between the years 1805 and 1811, in pounds sterling.

1805,	11,446,939
1806,	12,865,551
1807,	12,097,942
1808,	5,302,866
1809,	7,460,768
1810,	11,217,685
1811,	1,874,917
Annual average of three years, ending 1807,	12,163,811
Annual average of four years, ending 1811,	6,464,059†

† From the London Monthly Magazine for July, 1812. *Editor.*

ton yarn in England has commanded the extravagant price of five guineas: so much has machinery added to the original value of the raw material, which, on an average, may be rated at 20 cents per pound! England, from these causes, progressed more in the last 50 years of the 18th century, than she did in any equal number of years in any former century. In the time mentioned the most useful inventions were brought to light and made perfect—with the arts the nation flourished, and assumed the form of a political *Colossus*.

We need not abandon our country to seek for examples where a nation has been benefited and enriched by the genius of her citizens. We could specify many instances of the kind. On this occasion, however, we will content ourselves with a consideration of that of Mr. Eli Whitney, a native of the state of Massachusetts: it is to his *cotton gin* that many in the United States owe their wealth and comforts; but for this or some equivalent instrument, poverty, barrenness, and waste would infest an extensive and valuable portion of the United States. The opinion of judge Johnson, an inhabitant of South Carolina, is too appropriate to be omitted: in deciding in the case of Whitney vs. Carter, he proceeded, "With regard to the utility of this discovery, the court would deem it a waste of time to dwell long upon this topic. Is there a man who hears us, who has not experienced its utility? The whole interior of the southern states was languishing, and its inhabitants emigrating for want of some object to engage their attention and employ their industry, when the invention of this machine at once opened views to them which set the whole country in active motion. From childhood to age it has presented us a lucrative employment. Individuals who were depressed with poverty and sunk in idleness, have suddenly risen to wealth and respectability. Our debts have been paid off; our capitals increased, and our lands are trebled in value. We cannot express the weight of obligation which the country owes to this invention—the extent of it cannot now be seen." Edwards, in his history of the West Indies, says, the *green seed* cotton offers many advantages to the manufacturer, but for the

want of a proper instrument to separate the wool from the seed, "the value of the commodity is not equal to the pains that are requisite in preparing it for market." Before the gin was invented, this species of cotton was only cultivated for domestic purposes, and for supplying wick for the lamps that are used in sugar boiling. Formerly cotton wool was imported into the United States; that obtained from the British West India possessions, on an average of three years, from 1768 to 1771, amounted to 167,748 lbs. and from other places 266,182 lbs. In 1783, after the peace with Great Britain, it was proposed we might furnish ourselves with the necessary quantity of cotton wool from the Dutch settlements at Surinam—no one then imagined it could be cultivated in the United States to be made an object of commerce. In 1791 it was proved that cotton might be cultivated to advantage in the United States. In the same year, 19,200 lbs., the growth of the United States, were shipped to Europe, and the want of a machine to separate the wool from the seed was soon found to be essentially necessery. But for the invention of Whitney, which was brought to perfection in the year 1793, the United States would have continued to be *importers* of this article. The annual quantity made increased every year, until in 1810, we exported of the growth of the country, 93,261,462 lbs., of which quantity 8,604,078 lbs. only, were sea island or long staple. Besides the quantity exported, 16,000,000 lbs. of the short staple are annually consumed in our country, which give an annual crop of 100,000,000 lbs.; this, at fifteen cents per pound, presents us with an annual income of $15,000,000. If the *saw gin* of Whitney had not been brought to light, the green seed cotton could only be cultivated by those planters who have a superabundant number of labourers on their plantations to give them employment, at times when they otherwise would have gone idle. Sea island cotton can only be raised in a very limited district of the union, and it is not so fit for all purposes as the other species. By hand an industrious man may pick 1 lb. of cotton per day; a machine of a moderate size, attended by a boy to feed it, will do the same for 1000 lbs. per

day. Horse, water, or steam power may be applied. One man may readily attend ten of these. The quantity they would furnish for packing is incalculable.

The facts we have just stated are known to all our cotton planters. Such of them as are connected with commerce, are derived from the treasury reports and books of authority on the subject. We could mention many other instances where valuable machines have benefited the United States. This is considered superfluous. Your committee, for the reasons which they have already assigned, must remain satisfied with offering this *report*, in part, for the present. Had time and circumstances permitted, they would have presented for your consideration, a detailed system, with rules and regulations for its execution. They indulge in the hope to furnish these at a more suitable time.

REMARKS.

The foregoing excellent report of the Committee, of which Dr. Seybert was chairman, contains many important truths, and will no doubt command the early attention of Congress. The patent laws of the United States imperiously demand a revision, and the whole establishment a new organization. The patent-office might then become, under proper regulations, a *school of arts*, from which the most important benefits might result to the United States. This subject shall be resumed. *Editor.*

PAPERS ON

RURAL AND DOMESTIC ECONOMY.

Directions for preventing calamities by FIRE. *Recommended by the "Massachusetts Fire Society;" with notes and additional directions by the Editor.*

1. KEEP your chimnies and stove pipes clean, by sweeping them at least once every month.

2. Never remove hot ashes in a wooden vessel of any kind, and look well to your ash hole.

3. After sweeping a hearth, see that the brush does not retain any particle of fire before you hang it up in any usual place.

4. Oblige all your servants to go to bed before you, every night, and inspect all your fire places before you retire to rest. For fear of accident, let a bucket of water be left in your kitchen every night. The writer of these directions once saved a house from being consumed by fire, by this precaution.

5. Do not permit a servant to carry a candle to his bed room, if he sleeps in an unplaistered garret.*

6. Cover up your fire carefully every night in ashes. Let the unburnt parts of the billet or chunks of wood be placed next the hearth, but not set upright in the corners, by which means no sparks will be emitted from the wood. Pour a little water upon the burning ends of the wood which are not completely covered by the ashes. Place before the fire a fender made of sheet iron. This contrivance was well known in England many years ago, by the name of Coversen. It has lately received (from a top being added to it) the name of hood.

* If they must have a light, let them take a small hand-lantern, surrounded with iron wire: such are made in Philadelphia for the purpose. *Editor.*

7. Remove papers and linen from near the fire, to a remote part of the room.

8. Shut the doors of all the rooms in which you have fires at night. By thus excluding the supply of fresh air, you will prevent a flame being kindled, should a coal or spark fall upon the floor, or upon any of the combustible matter in the room. The smoke which issues from the smothered fire, will find its way in every part of the house, and by waking the family may save it from destruction.

9. If sickness, or any other cause should oblige you to leave a candle burning all night, place it in such a situation as to be out of the way of rats. A house was once destroyed by a rat running away with a lighted candle for the sake of the tallow, and conveying it into a hole filled with rags and inflammable matter.*

10. Never read in bed by candle light, especially if your bed be surrounded by curtains.

11. Strictly forbid the use of segars in your family at all times, but especially after night. May not the greater frequency of fires in the United States than in former years, be ascribed, in part, to the more general use of segars, by careless servants and children? There is good reason to believe a house was lately set on fire by a half consumed segar, which a woman threw away, to prevent being detected in the unhealthy and offensive practice of smoking.†

12. Leave your shutter open in the rooms where fire has been kept.

In case of fire, attend to the following directions, to prevent or restrain its terrible consequences.

1. Do not open the room or closet door, where you suspect the fire to be, until you have secured your family and most va-

* A high funnel, or speaking trumpet put over the candle, would answer. *Editor.*

† A barn was burnt in New Jersey not long since from a boy smoking a segar in it. *Editor.*

luable effects, nor until you have collected a quantity of water to throw on the fire, the moment a fresh supply of air excites it into a flame. Where water cannot conveniently be had, try to smother the fire by throwing two or three blankets over it. A British sea captain once saved a king's ship, by throwing himself, with a spread blanket in his arms, upon a fire which had broken out near the powder room. He was pensioned for life for this wise and meritorious act.

2. In case it be impossible to escape by a stair-case, from a house on fire, shut the door of your bed-chamber, and wait until help can be brought to secure your escape from a window.

3. If safety does not appear probable in this way, wrap yourself in a blanket, hold your breath, and rush through the flames. If water be at hand, first wet the blanket.

4. To prevent fire descending from the roof, or ascending from the first story, form by means of blankets or carpets, a kind of dam on each side of the intermediate stories, near the staircase, that shall confine the water that is thrown upon the roof, or into the windows. It will effectually check the progress of the fire downwards or upwards in brick or stone houses.

5. To prevent fire spreading to adjoining houses, cover them with blankets, or carpets, or old sails wet.

6. To extinguish fire in a chimney, shut the doors and windows of the room, or throw a quart or more of common salt into the fire. Hold or nail a wet blanket before the fire place. If these means fail, throw a wet blanket down the chimney from the roof of the house.

There is a method used in some countries of glazing chimneys, when they are built, by burning common salt in them, which renders them so smooth that no soot can adhere to them. Chimneys so constructed can never catch fire.*

Ladders are commonly used as the means of conveying persons from the windows of houses on fire. Would not a long and

* The mode of constructing and of plastering chimneys so as to prevent the collection of soot, shall be given in a future No. of the Archives. *Editor.*

stiff pole, with a rope fixed on its upper end, be more portable and convenient for that purpose.

The famous Mr. John Wesley, when a child, was taken out of a window in his father's house whilst in flames, by one man standing upon the shoulders of another.—This practice may be used to rescue persons from the first story of a house on fire, when other means cannot be had with sufficient convenience or expedition.

Additional directions by the Editor.

To extinguish fire in the clothes of Women and Children.

Wrapping the sufferer up in a carpet, if there be one on the floor, and not nailed down, or a great coat, or blanket, will answer the effect; or "passing the hands under the clothes, to the sufferer's shift, and thus raising them together over the head.* If the female folds her arms before her, the business will be facilitated; and if alone, she may in most cases relieve herself by throwing her clothes over her head, and rolling or lying upon them." Tilloch's Philos. Mag. No. 118.

It should be explained to females and children, that as flame always flies upwards, if they continue in an upright posture, the fire has a greater power, and the neck and head run a great chance of being hurt. It is, therefore, better to throw themselves upon the floor or ground, and roll themselves on their clothes, which will retard the progress of the fire until assistance be procured. Philos. Mag. No. 122.

The Editor knew a child to be saved, many years since, from death, after its cotton frock had taken fire, by an old lady rushing into the room, pressing the child close to her, as he stood, wrapping its body up in her spacious gown, closing it at the same time round the neck, so as to prevent the current upwards. The fire was thus smothered in an instant. A MODERN FASHIONABLE LADY, with her narrow skirt, could not do this.

* Raising the clothes up and closing them well round the neck, will obviate the danger, of suffocation, arising from throwing the clothes over the head.

Editor.

In case of scalding water falling on the feet, they should be plunged into cold water as quickly as possible, without waiting to pull off the stockings if they are on; for the skin will inevitably come off with them, and increase the pain greatly. When the first agony of the sufferer is over, the stocking may be cut off.

When a room is on fire, the smoke being lighter than the common air, always ascends: it has been advised, therefore, to creep on the hands and feet, to remove any object; and it is stated in the London Monthly Magazine for January 1812, that the linen having taken fire at Corby Castle, the destruction of the premises was prevented by these means. It was attempted in vain to enter the room in an erect posture, without danger of immediate suffocation, but by crawling or stooping low, the atmosphere near the floor was found so clear, that it was entered without inconvenience, the linen saved, and that part which was in flames dragged out.

METHOD OF CLEANING MUSTY CASKS.

By M. Lenormandes.

From the Annales des Arts et Manufactures.*

THE author mentions, that he was taught the secret by a countryman.—He took, says he, " cow-dung *very fresh*, and diluted it with warm water, so as to make it sufficiently liquid to pass readily through a large tunnel. He previously dissolved in this water 4 lbs. of common marine salt, and one pound of alum. The quantity of this liquid, was equal to about a sixteenth part of the capacity of the cask. He put the whole in a pot, and heated it to ebullition, stirring it continually with a wooden spatula. He poured the hot liquor into the barrel, bunged it tight, and shook it five or six minutes every two hours, taking care, after every shaking, to pull out the bung, when a thick vapour,

* Translated in Repertory of Arts, Vol. I. New Series.

with a strong smell of must, issued from it. Twenty-four hours afterwards, he rinsed the barrel till the water came from it perfectly clear. During this operation, some water was heated, in which had been put two pounds of salt, and half a pound of alum, which he poured quite hot into the barrel; he shook it once, as in the former operation, and left the barrel well bunged. Two hours after, the water being still warm, he emptied it out, leaving the barrel to drain, and bunged it up very tight, till it should be wanted for use. A greater quantity of cow-dung, salt, and alum, than the above, will not injure the operation.—Cow-dung must be used, that of oxen is useless.

ON THE DIFFERENT DURABILITY OF CANDLES.

IN p. 57, the result of an experiment on the burning of two candles of the same size, (sixes to the pound) was mentioned, and the cause of the difference of the time required for their expenditure, was attributed to the difference in the firmness of the suet used in their composition. The greater or less degree of firmness, was referred to the nature of the animals producing it, and to the food by which they had been fattened. Other causes however contribute to the same effect: these are,

1. The material composing the wick. Wicks of cotton, cotton and tow, or tow alone, and one strand more or less, will cause a candle to burn a longer or shorter time, although of the same size and same number to a pound.

2. The degree of fatness of the animal, from whose suet a candle is made, has a great influence on its durability. It is constantly found that the fat of over ripe animals, whatever may be the nature of the food, does not make candles of so good a quality, as the fat from beasts moderately fat: the fat in the former being more oily and less firm, than in the latter. With respect to the qualities of the fat of different quadrupeds, the intelligent mechanic from whom the foregoing facts were obtained, added, that beef suet, when the animal was not over-fat, made the best candles: that South American fat of a good quality, that

is, white, which is exported in skins from La Plata, and is the product of wild oxen moderately fat, makes excellent candles, and will bear the heat of a warm climate better than candles made from any other fat: but owing to the careless manner in which the fat is melted by the natives of South America, it is often burnt and discoloured, and from this cause it happens that but a small quantity in a skin, will answer for that purpose.

3. Stall fed animals, and such as are fed upon oil cake, do not make as firm fat, as when the animals graze at large, or are wild: and hence the candles sent from England, (where flax-seed cake constitutes a chief part of the sustenance of cattle in the stalls) do not keep well in the West Indies, while those from North America, remain firm and do not run. In the United States it is well known that Indian corn enters largely into the food of all stall-fed cattle.

FRENCH RATAFIA.

COMMUNICATED BY A LADY.

TO four quarts of brandy, take four ounces of the kernels of apricots and peaches; bruise them in a mortar; take the thin parings of twelve lemons and six oranges; bruise an ounce of coriander seed; break half an ounce of cinnamon in small pieces; and take twenty whole cloves; mix all these with the brandy, and let them stand a month or six weeks, stirring them frequently; then strain all through a sieve, clarify, and make a fine syrup of a pound and a half of fine loaf sugar, which mix amongst the spirits, and bottle it up; put the corks loose in, and let it stand until it is quite fine, then pour it from the grounds into other bottles—and the materials left, with the addition of a little more brandy, makes a good cordial or good seasoning for puddings, &c. If you cannot procure apricots and peaches, bitter almonds will do, only take but half the quantity.

SCOTCH MARMALADE.

The people of Scotland it is well known, are famous for Marmalade, and often prefer it to butter at breakfast. Mrs. Boswell sent from Edinburgh to Dr. Johnson in London, a pot of the article of her own make, as a great present. The following receipt as well as the preceding one, is communicated by a lady from Scotland, who is eminently skilled in the knowledge of domestic economy.

TAKE the same weight of oranges, as of sugar; grate one half of the roughest part of the oranges, and pour boiling water over the grate. Cut the fruit across as a lemon for punch, and squeeze them through a sieve, boil the skins tender, and scrape the inside all out; then cut them into very small chips, and let them boil until they are transparent. Then put in the juice, and the water strained from the gratings, and let all boil together until the juice jellies, which you will know by cooling a little of it in a saucer.

TO PRESERVE HAMS,

OR OTHER SMOKED MEAT THROUGH THE SUMMER.

WRAP up the meat in tow, of either flax or hemp, after shaking out the loose shives, and pack it in a tierce or barrel, taking care that there be next the tierce and between every piece of meat, a thick layer of tow packed in as close as possible; then set it away in a dry cellar or upper room. It is enough that the barrel or tierce be sufficient to keep the mice out, as no fly or insect will enter the tow.

Tow and flax are such bad conductors of heat, that a piece of ice will be preserved a long time wrapped up in tow. Cut straw also answers extremely well to keep hams in. Ashes are apt to communicate a bad taste to meat. Care should be taken to prevent the flies from having access to the meat before being packed away.

ON SPONTANEOUS INFLAMMATION.

ABOUT the 10th of July 1812, twelve hundred bushels of Virginia coal were put into a close cellar in Philadelphia; and about the middle of September, the owners wishing to remove from the establishment, sold a great quantity of it. The coals were then found to be so hot, and to emit so much smoke, as to excite alarm, and required several hogsheads of water to cool them. This coal contained a considerable quantity of sulphur. The same quantity of coal had been put in the same cellar, several times during the last five years, without shewing any disposition to heat.

About the time that the occurrence just mentioned took place, the coal in the great vault at the water works, at the Centre Square, containing between 16,000 and 18,000 bushels of coal, also from Virginia, was observed to be very hot, and upon removing the surface of it, under one of the vault trap-doors, which are even with the ground, a dense smoke immediately issued. By throwing out several hundred bushels of the coal, and pouring an immense quantity of water into the vault, the progress of the combustion was checked. Such was the degree of heat extricated, that one man could not stay in the vault to shovel out the coal more than a few minutes at a time: some lumps of coal were completely reduced to cake. The vault had been filled to the top, and was of course deprived of air.

In the memoirs of the Royal Academy of Paris, it is stated that two magazines containing each about twelve hundred chaldron of stone coal, took fire shortly after they were filled. The magazines were built close and compact, they were also covered in and filled close to the top. After the fire was extinguished, a rafter of deal which was within the building near the door, was found half burnt, and a beam which the coal touched, was in the same condition; they had not flamed, but were burnt quite through to a cinder: the coals that lay on the top of the heap were only warmed by the smoke that had passed through them, but those in the middle had lost their inflammability and were

half calcined, but near the bottom they had suffered no injury, nor even contracted the least heat. It is also stated that previously to the construction of those magazines, coal had been constantly kept under a frame shed in vast masses, constantly exposed to the weather without accident.*

A similar accident took place in Philadelphia some years since, from a large quantity of Virginia coal being heaped under a close arch.†

In the year 1794, 1600 tons of coal which had been collected at the king's ship yard, Copenhagen, inflamed after some time, and was entirely consumed, together with 1400 houses.

In the Domestic Encyclo.‡ (article Inflammation) the editor has enumerated some substances, which under particular circumstances spontaneously inflamed; and it may be serviceable to mention, as a caution to woollen manufacturers, that it is stated in a Liverpool paper, that a destructive fire at Lodgemore mills near Stroud in Gloucestershire, which happened in June 1811, was occasioned by a quantity of flocks impregnated with Curriers oil being left on the floor.

* Gentleman's Magazine, 1763.

† See Dr. Seybert's paper on Spont. Comb. Med. Repos. Hexade 3d. vol. 3. p. 220.

‡ Philadelphia edition, 1803.

PAPERS ON AGRICULTURE.

ON THE CULTIVATION AND MANUFACTURE OF WOAD. IN A LETTER TO THE PRESIDENT OF THE BATH AND WEST OF ENGLAND AGRICULTURAL SOCIETY. BY MR. JOHN PARRISH.

(Continued from p. 63.)

HAVING said all I conceive necessary on the cultivation of woad, I now proceed to say something on its preparation for the use of the dyer.

Woad, when gathered, is carried to the mill, and ground. I need not describe this mill, because they are to be seen in open sheds in several parts of England, only that I conceive some improvement might be made in their construction, so as not so much to press out and waste the sap, which contains the very essence of the dyeing principle. These mills grind or cut the leaves small, and then they are cast into heaps, where they ferment, and gain an adhesive consistence;* they are then formed into balls, as compact as possible, and placed on hurdles lying horizontally in a shed one over the other, with room for air between, to receive from the atmospheric, air a principle which is said to improve them as a dye, as well as to dry them to a degree proper for being fermented; but in summer these balls are apt to crack in drying, and become fly-blown, when thousands of a peculiar maggot generate, and eat, or destroy all that is useful to the dyer. Therefore they require attention as soon as any are observed to crack, to look them all over well, close them again, so as to render them as compact and solid as possible; and if the maggot or worm has already generated, some fine flour lime strewed over it will destroy them, and be of much service in the fermentation. These balls, if properly preserved, will be very heavy; but if

* In a dry place, if these leaves remain a fortnight, being occasionally turned, they will become more adhesive, and have less juice to squeeze out in balling. The balls must be compact.

worm-eaten, they will be very light, and of little value. They are then to be replaced on the hurdles, and turned, not being suffered to touch each other, until a month or more after the whole that is intended for one fermenting couch is gathered in, ground, and balled, and often until the hot weather of summer is past, to render the offensive operation of turning it less disagreeable, and not so apt to overheat; and though temperature herein is necessary, yet a certain degree of heat must be attained, before it is in proper condition for the dyer's use. This is easily distinguished by a change of smell—from that which is most putrid and offensive, to one which is more agreeable and sweet, (if I may be allowed the term,) for few people at first either can approve of the smell of woad, or of a woad vat; though, when in condition, they become quite agreeable to those whose business it is to attend them. Woad is in this state of fermentation more or less time, according to the season and the degree of heat it is suffered to attain, whether at an early period, or according to the opinion of those who attend the process; but the best woad is produced from a heat temperately brought forward in the couch until at maturity, and turned, (on every occasion necessary,) which a proper degree of attention will soon discover.

These balls, when dry, are very hard and compact, and require to be broken to pieces with a mallet, and put into a heap, and watered to a due degree, only sufficient to promote fermentation, but not by too much moisture, which would retard it; and here is a crisis necessary to be attended to. When the couch has attained its due point, it is opened, spread, and turned, until regularly cooled, and then it is considered in condition for sale: but the immediate use of woad new from the couch is not advised by dyers who are experienced; for new woad is not so regular in its fermentation in the blue vat. This is the common process. Woad oftentimes is spoiled herein, by people who know nothing of the principles of its dye, following only their accustomed process of preparing it; and hence the difference in its quality is as often seen, as it is in the real richness or poverty of the leaves, from the quality of the land. The process for preparing woad

which I have followed, and which I consider beyond all comparison best, is as follows:

Gather the leaves, put them to dry, and turn them, so as not to let them heat, and so be reduced to a paste; which, in fine weather, children can do. In wet weather, my method was to carry them to my stove, and when I had got a quantity sufficiently dry, I proceeded to the couch, and there put them in a large heap; where, if not too dry, they would soon begin to ferment and heat. If too wet, they would rot, but not properly ferment, nor readily become in condition for the dyer. These leaves not having been ground, nor placed in balls on the hurdles, their fermenting quality was more active, and required more attention; and also the application of lime occasionally to regulate the process with the same kind of judgment as used in the blue dying woad vat. When the heat increases too rapidly, turning is indispensably necessary, and the application of very fine flour lime regularly strewed over every laying of them; or, if the couch is getting too dry, lime-water instead of common water, applied by a gardener's watering-pot, may have an equal effect,* without loading the woad with the gross matter of the lime; though I conceive that the gross dry flour lime, and the oxygen in the air, will furnish more carbonic acid gas to the woad, and retain such principles as are essential, to a better effect. For I have experienced, that woad which requires the most lime to preserve a temperate degree of fermentation, and takes most time, is best, so that at length it comes to that heat which is indispensable to the production of good woad.

In this couch it is always particularly necessary to secure the surface as soon as the leaves begin to be reduced to a paste, by rendering it as smooth as possible, and free from cracks: this prevents the escape of much carbonic acid gas, (which is furnished by the lime and the fermentation,) and also preserves it from the fly, maggots, and worms, which often are seen in those parts

* There is in lime-water so little of its salt, that its effect is proportionably small, and water will take up but a certain quantity.

where the heat is not so great, or the lime in sufficient quantity to destroy them; it is surprising to observe what a degree of heat they will bear. This attention to rendering the surface of the couch even and compact is equally necessary in either process, and to turning the woad exactly as a dung-heap, digging perpendicularly to the bottom. The couching-house should have an even floor, of stone or brick, and the walls the same; and every part of the couch of woad should be beaten with the shovel, and trodden, to render it as compact as possible.

The grower of woad should erect a long shed in the centre of his land, facing the south, the ground lying on a descent, so as to admit the sun to the back part; and here the woad should be put down as gathered, and spread thin at one end, keeping children to turn it towards the other end. In the course of a week, every day's gathering will be dry for the couch, which should be at the other end; therefore it will be necessary to calculate how long the shed should be; but this can be erected as you gather, and then it will soon be known.

I never used the thermometer to discover or determine the heat which is necessary to produce that change of smell which finishes a couch of woad properly for the dyer,* but I am convinced it cannot be regularly obtained but by temperance and time.

Good woad, such as the richest land produces, if properly prepared, will be of a blackish green, and mouldy; and when small lumps are pulled asunder, the fracture and fibres are brown; and these fibres will draw apart like small threads, and the more stringy they are, and the darker the external appearance and on the green hue, the better the woad; but poor land produces it of a light-brownish green. The fibres only serve to show that it has not suffered by putrefaction.

Considerable fortunes have been acquired by the culture of woad in the North of England, and those who have not in possession land sufficient of proper staple, will give an extra rent for leave to break pasturage; and such as is old, and its sod worn

* I suppose from 100 to 120 degrees.

out and full of ant-hills from long feeding, is equally good, when lime is applied to destroy these and other insects, which here exist more than in such as is in full proof to bear grass; for here they generate and become destructive, so as often to render it very necessary to plough such land, corn it, and form a new turf; and though this is so often prohibited, yet it is often consistent with the best principles of husbandry. Here woad is every thing, and corn after it to a certain degree, which experience will determine, according to the kind of land. Those who grow woad in large quantities, have moveable huts for their work-people; and also all their apparatus so easily put together, as to be of little expense except in carriage.

A friend of mine in London took a large quantity of land whereon had been wood just grubbed up. He planted woad on it, and engaged a person from the North to manage it; and the produce was so abundant as to afford immense profit. I believe he only woaded two years, and then let it. His tenant's produce did not by any means equal his, because the land began to want change. I know not how he succeeds in corn, but I presume he did well, as it is a fine preparative for it.

FIORIN GRASS.

AS mentioned in Archives, vol. 2. p. 268, this grass has been found native. Mr. John Clifford of Philadelphia county, who has the imported grass growing with great luxuriance, found the native grass in abundance in a lane in his vicinity. The Editor also found it in July last, at Saratoga Springs in New-York; and the Hon. Mr. Peters, Pres. Phila. Agric. Soc., lately showed the plant to him in a small brook running through his farm. Mr. Peters has also the imported grass growing from some stolones planted in June last; and to prove its extreme hardiness and strong vegetative power, it may be mentioned that the plants had been wet with salt water on the voyage. They had not the least appearance of life when put into the ground. Fiorin may therefore be considered as secured to the United States.

ACCOUNT OF SUBTERRANEOUS CULTURE IN PARIS.

Communicated to the Editor, by M. Corea De Serra.

IT is well known that the species of mushroom called by the botanists *Agaricus campestris*, and by the French *Champignon*, of which a great use is made in European cookery, is an object of culture both in England and France. Couches of a proper compost, and manured in a peculiar way, are prepared to receive the white substance which the English call mushroom spawn, and the French, Blanc de Champignon; and these couches are covered by shadings generally made of rye straw, in order to imitate the process of nature, which has allowed shady and moist places for the growth of these plants. In a few days the little mushrooms begin to appear; and when of proper size, they are gathered and sent to market. Light and dryness are their enemy, and a constant attention is bestowed by gardeners to defend them from the effects of both.

A gardener and nurseryman of Paris, whose garden is situated between the Barriere St. Jacques, and the Barriere de la Santè, on the east side of the Observatory, has very ably and ingeniously taken advantage of one of the immense and deep subterraneous quarries, from which the calcareous stone used in the construction of the houses of that vast capital, have been taken; and there, at the depth of at least fifty feet under ground, he practices on a large scale the culture of this mushroom. The opening of the quarry is situated in his garden; two ladders, (because the excavation has two floors), are the means of communication with this subterraneous garden and that above; all the area of the meanderings and extensive galleries of this quarry, which is considerable, are covered with proper compost, and properly manured, except a narrow path in the middle; and the mushroom spawn is put there as in the ordinary culture, and as neither light nor dryness are to be feared in such a place, and a constant equal temperature is felt at that depth, no other care of them is required, but to observe their growth in order to gather them. In winter and the autumn, he has the competition of other gardeners and country people, but in the spring and summer he is almost

the sole vender to the Paris market, because he can sell them cheaper than others could do. He needs not, from the singular nature of his plantation, bestow any of the particular attentions the others are obliged to give, nor is he exposed to have his crops suddenly destroyed by thunder storms, as constant observation has shown to be the case of mushrooms exposed to the atmosphere, though shaded. His concern in this cultivation is of some importance, since according to his account, which seems far from exaggerated, he sells commonly in a year for about twelve hundred dollars of mushrooms, from which we must deduct somewhat above six hundred dollars of the expenses of this singular cultivation, which is all performed by candle light.

Another more common subterraneous culture, is that of the sallad which the French call *Barbe de Capucin*, and which is by far one of the most sightly and palatable that appears on a table. Roots of wild chicory (*Cichorium intybus*), are deprived of all their leaves, disposed on layers covered with sandy earth, on shelves in a case, far from light. There they expand new radical leaves, but produce no stem. These leaves come to an unusual length, are perfectly discoloured or of a yellowish white, succulent, tender, and of a sweet taste when compared to the original bitterness of the wild chicory, but still retaining a weak degree of it, which prevents their tasting mawkish. The bundles of this sallad still adhering to the roots, grace during some months the stalls of the Parisian markets, and the green grocer's shops of that metropolis.

EULOGIUM ON MR. BILLINGSLEY.

The following energetic and impassioned tribute to the memory of an eminent British agriculturist, and a highly respectable man, the late Mr. Billingsley, was delivered by ***Benjamin Hobhouse, esq.*** President of the Bath and West of England Society, at the last annual meeting on the 17th December 1811.

" THE moment is arrived, Gentlemen, when we are called upon to exercise a sad and painful office :—we are seeking to obtain a good resemblance of our late much-lamented Vice-President, Mr. BILLINGSLEY ; and we are now to determine whether a Bust or Portrait will best answer the melancholy, but, at the

same time, in some degree consolatory purpose. At our last Anniversary, we had the pleasure, the delight, I may say, of seeing this most estimable and amiable man amongst us; but "the eye which hath seen him, shall see him no more." Rare and extraordinary were his talents: Nature had endowed him with a powerful and vigorous understanding, which it was his anxious and unremitting endeavour to enrich with knowledge. In the early part of his life his attention was given to the Woollen Manufacture, but after a few years he was determined to abandon that employment. Let me not be understood, Gentlemen, to undervalue the pursuit of the Manufacturer, when I state it as a matter of joy that Mr. Billingsley's talents were finally diverted into another course. The occupation of a manufacturer is great and important in society; but at the period when Mr. Billingsley quitted that destination, a field of greater usefulness was open to him; a department more congenial to his taste invited his entrance. It is notorious, that the Agriculture of this country, whether owing to our insular situation, or to the superior activity of our tradesmen and merchants over the tillers of the earth, or to any other cause or causes, had not advanced with the same rapidity as our manufactures and commerce. It might have been said of this kingdom, previously to the establishment of this Society, which was founded in 1777, that the principles of Agriculture were but little understood; that the implements of husbandry were in a very rude condition; and that the live stock of the Farmer was far distant indeed from that perfection, which it has since attained. This was the degraded state of Agriculture, at the period when Mr. Billingsley, aided by a few other congenial and public-spirited individuals, applied his powerful understanding to its improvement; and the means which he adopted were well calculated for the attainment of that most desirable end.—Aware that the true system of philosophizing is founded on facts, he had recourse to experiments; and he conducted them with all that care and attention, without which they cannot be productive of the smallest degree of utility. With the result of one or two trials he was not contented; he often, very often, repeated the same experiment; and if the result were invariably

the same, he then, and not before, ventured to draw his conclusion. His successful exertions we have all witnessed; and we all know how liberal he was in communicating his knowledge, and in how able and forcible manner he conveyed it. I am persuaded, Gentlemen, you will all agree with me, that the death of such a man is a great national misfortune. The numerous prize compositions of Mr. Billingsley, which through the volumes of our transactions have found their way to the public eye; and his agricultural survey of the county of Somerset, approved and printed by the board of Agriculture; cannot but excite universal regret that this intellect has for ever ceased to shine, and that from this once abundant source of information no stream can longer flow. But still the portion of affliction which falls upon this society, is the heaviest. We not only feel in common with the nation and the world, for the loss of one who might have continued to spread knowledge for the benefit of mankind; but having had the advantage of deriving wisdom from his lips, we have to lament, that cold is the tongue which gave life and animation to our discussions. Having a mind stored with knowledge, in the application of which he was peculiarly prompt and happy, no question could be brought under consideration, upon which he had no power to enter. When points of intricacy have been started, has he not, by the strength of his reasoning powers, stripped them of all their difficulties? His investigating mind was never satisfied with taking one view only of a subject; he examined it on all sides with accuteness and penetration, and never ceased to sift it, until the course fit to be pursued was rendered plain and easy. In a word, the death of Mr. Billingsley has inflicted a severe and lasting wound in the bosom of this society, whose interests were peculiarly dear to his heart, and to the advancement of whose prosperity the great bent of his genius was principally directed.

"Hitherto, Gentlemen, I have only adverted to the talents of Mr. Billingsley. To detail his virtues would be impossible; and indeed it is unnecessary, as they are so well known to you. His ruling passion was the love of mankind. He could not hear a

distressing fact, without shedding tears; and the suffering which he bewailed, he always sought to relieve. This I, who being distinguished by his friendship, have still further cause for sorrow, who admired, revered, and loved him, can truly testify. In confirmation of my correctness, I appeal to the many around me, who had the honour of being intimately acquainted with him. His desire to promote the happiness of mankind was evinced in the whole course of his life. To heal differences, and restore harmony, was the favourite pursuit of his mind. Judge, then, how his heart must have been rent by the disputes and litigation in which, towards the close of his life, he was unhappily involved. The immediate cause of his dissolution was, perhaps, that sensibility of mind which so strongly marked his character. I shall not enter into any of the particulars of those unfortunate differences, nor would it be fitting here to pronounce any opinion on the subject. Suffice it to say, that had it pleased the Great Disposer of all events to have spared his life for a few days only, he would have seen that innocence, of which he was proudly conscious, clearly established, and that integrity, which he valued more than life, firmly upheld by the unanimous award of the arbitrators, to whom the final adjustment of the matters in litigation was committed. But such was not the will of Heaven; and to the dispensation of Providence, however unsearchable by us, it is the duty of man to submit with implicit resignation, from a conviction, that under the superintendance and controul of unerring wisdom and perfect benevolence, "whatever is, is right."

"During the short time which I have painfully employed in paying this last tribute due to the memory of my departed friend, our late excellent Vice President, I have perceived that your emotions were in unison with mine; and that you felt it impossible to suppress the throbs which agitated your bosoms. Such bursts of overwhelming sorrow are far more valuable testimonials of the merit of him, whom the Divine Being has thought fit to remove to another and to a better world, than "the pomp and circumstance" of funeral procession. His virtues are embalmed in your hearts; may the remembrance of them be manifest in your lives!"

PAPERS ON THE USEFUL ARTS.

METHOD OF PREPARING A CHEAP AND DURABLE STUCCO, OR PLASTER, FOR OUTSIDE WALLS.

By H. B. WAY, *of Bridgeport Harbour.**

THREE parts of Bridgeport Harbour sand, to one of lime, both finely sifted, and mixed with lime-water; if used as stucco, the first coat to be laid on half the thickness of a crown-piece: let it remain two days, then with a painter's brush wash it over with strong lime-water, and lay on the second coat of the same thickness. A coal half-bushel of lime, was put into a hogshead of water, to make the lime-water; to two coal half-bushels more of lime, slacked and sifted, which then measured three half-bushels, were added nine half-bushels of sand sifted, and well mixed with lime-water; the next day it was again mixed up, that it might be well incorporated. The coal half-bushel contained exactly thirteen gallons of water, wine measure, and would exactly hold 1 Cwt. 1 qr. 7 lb. nett of the sand used.

Mr. Way says that his house is greatly exposed to the spray of the sea, and that by means of the stucco prepared according to his receipt, it is perfectly free from damp, and that the plaster remains (April 1811,) compact and durable. The work was done in March 1805.

REMARKS.

It is commonly believed, that plaster made with sea-sand, unless well washed with water, would be always damp, but Mr. Way found from what had been done in his dining parlour and passage, that it was always dry, although the whole of the sand

* Abridged from Trans. of Soc. for the encouragement of Arts, Manufactures, and Commerce, for 1811. London.

with which it was done, had been thrown up by the sea, and must have been always at spring tides, covered with sea water.

The following facts show that mortar very freely impregnated with sea salt, is even improved thereby.

Mr. Somerville was informed by the Earl of Wemyss, "that in completing a line of enclosure upon his estates, on the south side of the Frith of Forth, he was under the necessity of using salt water, not only for slacking the lime, but for bringing it to the consistence of mortar, after it was mixed with sand. Contrary to all expectation, the work done with the salt water, took band sooner than what was done with fresh water, and continues firm."*

The Editor has heard that a similar agreeable disappointment was experienced by a gentleman near the sea coast, in Jamaica, from the use of salt water in making mortar. The extraordinary solidity of the *Tabby* or Tapia walls of S. Carolina and Georgia, made of shells, shell lime and sand, also, may arise from the salt attached to the shells and sand. See article *House*, Domestic Encyclopædia, Philadelphia Edition.

ON LIGHT, &c.

BY COUNT RUMFORD.

Extract of a letter to the Editor, from R. R. Livingston, *Esq.*

New York, March 24, 1812.

TO change the subject to one more interesting to you, I have received from my friend Count Rumford, a very long, and very pleasing letter. This he accompanies with two pamphlets on light, as applied to domestic uses—and another on broad-wheels for carriages, both of pleasure and labour. As the two first have been printed as he tells me, merely to give away to his friends,

* Trans. Board Agric. London, Vol. 2d, p. 71.

they will not appear except in the proceedings of the Royal Society and the National Institute. I have therefore read them to our Society for Useful Arts, in whose journal they will appear.

After noticing the different theories of light, he adheres to that which supposes light not to form a part of the luminous body, but to be a vibration in the ether analogous to the vibration and undulation in the air that produces sound. If so, we must seek for the light which a flame produces in a high temperature of the different particles of matter which compose the flame; these particles will be luminous in the same manner as red-hot iron, and they will disappear whenever they are cooled to such a degree, as no longer to excite the vibration which operate upon the eye. If this hypothesis is just, it must follow, that the quantity of light will not bear an exact proportion to the inflammable matter consumed, because the volume and form of the flame, must necessarily have considerable influence upon the time it takes to cool. To show that this is really the case, he subjects the theory to several very interesting experiments.—He divides his photometre into degrees, which indicate, without any calculation, the relative intensities of two lights; a wax candle of 5 to the pound, having nine lines diameter, and ten and a half inches height, is his standard of light. The light of this, he calls 100°, and he divides into 100 parts, the quantity of wax burnt by this candle in an hour. His object was to determine, whether the quantity of light in a combustible body, was always proportioned to that of the body consumed. Argand's lamp, when quite clean, and burning purified oil, burns without smell or smoke. This was employed to determine the above question.

This was placed before the photometre and so regulated for thirty minutes as to give 100° of light, (the same as that furnished by the candle) at the end of the experiment, the lamp was extinguished. The result was that 228 parts of oil produced 100° of light, or in other words, 100 parts of oil gave only 48 of light, while the candle gave 100° of light for 100 parts of wax.

The lamp was again cleaned and lighted so as to produce

200° of light; in this experiment, 100 parts of oil gave 74° of light.

In a third experiment, the lamp was made to give 300° of light; the result was 98° of light for 100 of oil.

In the fourth experiment, the lamp was raised so as to give 400 of light, when it gave 112° of light for 100 of oil. In this experiment, a given quantity of oil, gave more light than the same quantity of wax. These experiments were continued through various grades, and it was always found, that the proportion of light to the oil consumed, was greater as the light was more intense.—Thus, when the light was 900°, the proportion of light to the oil consumed, was as 160° to 100 of oil consumed. That the difference of light, between the first and last experiments, was four to one, in favour of the greater light.

These experiments are very important in two views: 1. As they shew that more light can be obtained from oil, than from the same weight of wax—and next, that the quantity of light may be greatly œconomised by the form of the lamp. A variety of other experiments were made, which fully proved that a small flame, whatever be its form, gives much less light than a larger one in proportion to the oil consumed. The same experiments were repeated, with the same results, upon wax candles, and when the candle was extremely small, as a watch light, the proportion of light, was to the wax consumed, between that and the taper above described, as one is to sixteen—evidently because in this case, (if we admit his hypothesis) the particles of which the small flame was composed, cooled too soon to operate upon the eye with necessary force, and yet the wax consumed, proved that the combustion of both tapers was in proportion to each other, and so as appears by his farther experiments was the heat envolved, and which passed off in the current of air above the candle. From these premises he adduces, and I think fairly, that light is not a substance more than sound, and that any search after it, as a component part of bodies is idle. The whole pamphlet is very interesting. The second reduces his principle to practice in the invention of a variety of lamps, both portable and

stationary, which are now in use in Paris, and for which I shall write so soon as a safe means of conveyance offers. He tells me in his letter, that he has found the means of encreasing the light for light-houses to any given extent. You know how much this is wanted, and how vainly it has been attempted. He is now, he says, occupied in determining the quantity of heat produced in the complete combustion of wood of various kinds. These researches, like those of most American philosophers, are directed not to barren science, but to the most useful and important œconomical subjects.

The experiments on broad-wheels, are also very ingenious, and to me conclusive in their favour, but you will readily excuse, considering the length of this and its enclosures, my not entering upon them at present.

On the subject of salt, which you say you have noticed in your Archives, there is a remarkable fact, which is not, I believe, generally known: that is, that the salt itself is evaporated by rapid boiling. In the boiler of steam engine, tho' a vast quantity of salt water is evaporated, not a particle of salt is ever found. The condensed steam, however, when it comes in contact with the air, yields it in considerable quantities.

I am with much esteem,
Dear Sir,
Your most ob'dt. humble ser'vt,
ROBERT R. LIVINGSTON.

Dr. James Mease.

For the Archives of Useful Knowledge.

DESCRIPTION OF A METHOD OF LIFTING FORGE HAMMERS, OR STAMPERS FOR RICE, PLASTER OF PARIS, &c. WITHOUT NOISE OR PERCUSSION.

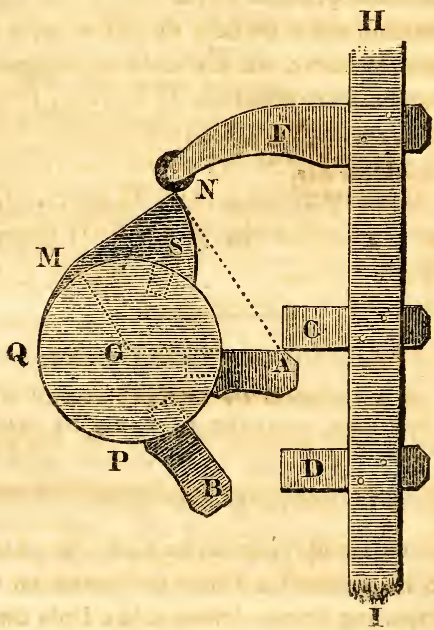
By Mr. John Garnett, *of New Brunswick, N. Jersey.*

WHEN heavy stampers are to be raised, in order to drop on the matters to be pounded, a stroke or percussion is given, that shakes the supporting frame, deranges in a little time the machi-

nery, and causes that deafning noise from stamping and fulling-mills heard at a considerable distance.

To remedy this, I have used with success, the following method, which first overcomes the vis inertiæ of the stampers, by *gradual acceleration*, until the required velocity is attained, and then continues this velocity *uniformly* to any required height of the stamper. Thus,

Let H I be a stamper in a vertical position, on which are fixed the spurs C, D, and *slider* or *sheeve* N. G P Q the section of a shaft or barrel, placed horizontally to lift the stamper by means of a wiper M N S lifting the slides F N, and teeth and tappets A B, acting on the spurs C, D; for as the barrel G revolves, the slider or sheeve N will slide or roll along the plane M N to the point N, where it will have given the stamper H I the *precise vertical velocity* of the pitch line of the teeth or tappets A B on the barrel; these teeth will then continue the velocity to any required height, according to their number and pitch.



To construct the Wiper M N S.

From the point G the center of the shaft, and A the pitch point of the first tooth or tappet draw any two parallel lines G M, A N, but not exceeding 30 degrees from the vertical, or making the angle G A N not less than 60 degrees; then any convenient line M N at right angles to, and joining these parallel lines, will give the length and position of the *wiper*.

Or a workman may be directed to place a carpenter's common iron square A N M on the point A, the pitch of the first tooth, at an elevation of not more than 30 degress from the vertical (G A being horizontal) then the part N M of the square will mark the required wiper. It is easy to demonstrate, (and may be a neat problem for some of your mechanical correspondents) that the point N of the wiper will give the same vertical velocity to the stamper H I as the pitch line of the teeth or tappets. The wiper may be in the same or a different plane from the teeth A B, as circumstances may require.

To give an example in numbers, the following would be found convenient for a stamper to be raised 18 or 20 inches :—

G A=14 inches; G M=$10\frac{1}{2}$; G N=$16\frac{1}{25}$ (which distances from the center G, can be found by revolving the shaft) then A N will be $17\frac{1}{2}$ inches and M N $12\frac{1}{8}$ which can readily be marked by placing a carpenter's square A N M on the point A to N $17\frac{1}{2}$ inches and drawing the line N M on the *wiper*.

New Brunswick, N. Jersey, JOHN GARNETT.
June 11, 1812.

DR. JAMES MEASE.

ON FREEZING WATER, UNDER THE AIR PUMP.

To the Editor of the Archives of Useful Knowledge.

SIR,

HAVING observed your account of Mr. Leslie's experiments in freezing water and mercury under an exhausted receiver; and the extract you have made from the Millwright's

Guide, published in Philadelphia, 1795; I beg leave to draw your attention to the three last pages of "The Abortion of the Young Steam Engineer's Guide," published in 1805. There you may see Mr. Leslie's discoveries anticipated in a greater degree. The principles and the machine there described, have long since been specified as the law requires, in the Patent-office of the United States, in order to take out a patent for the discovery, as soon as it shall be the interest of the discoverer to do so.

Another machine for producing cold, is also specified in the said office, to operate on principles seemingly opposite to the first: *viz.* a machine for condensing air to a greater degree in a strong metallic vessel immersed in water, or kept wet with water or other more volatile fluid to promote evaporation. The heat which the air contained, is thus squeezed out, and escapes through the metallic vessel into the water, or is carried off by evaporation.

This condensed air *robbed of its latent heat*, is to be permitted to escape, carrying a portion of water with it in the form of mist, into another vessel that will expand to receive it. The air expanded will need its portion of latent heat again, and it will rob the water of its latent heat, and freeze it into ice or snow.

OLIVER EVANS.

Phila. Aug. 2, 1812.

DR. JAMES MEASE.

LAW DECISION ON A PATENT RIGHT.

Communicated for the Archives, by one of the counsel.

DAWSON *versus* FOLLIN.

THIS was an action brought in the Circuit Court of the United States, for the Pennsylvania district to the April Session 1807, against the defendant, for nfringing the plaintiff's patent, securing to him a discovery and improvement in the manufacture of Suspenders. The schedule referred to in the letters patent, descri-

bed the improvement in the following terms :—" The suspenders are made of cotton, silk, leather, or other fit materials, and the springs in the usual form of the cat-gut springs. The web is attached to the front springs by means of two square eyes, and to the back springs by two clasps, with two buttons to each clasp. The web by means of two sliding clasps, without points, is moveable on the front eyes, and may be lengthened or shortened at pleasure, and when so lengthened or shortened, will remain in the situation placed, without the inconveniences attendant on the buckle in common use. The two clasps fixed to the back springs by means of the eyes, will permit the web to be detached from the springs, and also from the front square eyes, so that the web may without any inconvenience to the suspenders, be washed at pleasure, and by having two sets of webs, they may be kept clean and in a state agreeable to the wearer. The great advantages which these suspenders possess over those made in the common form, are the following: 1st. In the method of shortening, and lengthening them, by which the web is not cut with the points of the buckles. 2nd. The easy mode of detaching the web from the springs, for the purpose of washing or renewal."

The declaration contained three counts. The two first with some variation charged the defendant with *using* and *vending* the improvement, and the third count with *using part* of the improvement only. To this declaration the defendant pleaded the general issue, and under the 6th section of the act of congress, of 21st February 1793, served the plaintiff's council with the following notice.

"Sir,

"Take notice that the defendant in the above action, will give in evidence under the general issue in the said action, that the thing secured, or intended to be secured by the plaintiff's patent, was not originally discovered by the said plaintiff, but had been in use anterior to his supposed discovery." *For def'dt.*

The plaintiff grounded his action on his patent, which he contended, secured to him for a limited time, the exclusive right to

make and vend his improved suspenders, and that he was the inventor of the new mode of making suspenders, which in practice would be found a highly useful improvement. The patent to which the foregoing specification was annexed, issued under the authority of the act of congress, entitled " An act to promote the progress of the useful arts, and to repeal the act heretofore made for this purpose," passed February 21, 1793, vol. 2, page 200. The 1st section of the law gives the right to take out a patent to *citizens* of the United States only, " who have invented any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement on any art, machine, manufacture, or composition of matter not known or used before the application." This right by a subsequent law, passed the 17th of April, 1800, is extended to all aliens who have resided two years in the United States. The 6th section of the act of 1793, provides, " that the defendant in such action, shall be permitted to plead the general issue, and give this act and any special matter, (of which notice in writing may have been given to the plaintiff or his attorney, thirty days before trial), in evidence tending to prove that the specification, filed by the plaintiff, does not contain the whole truth, relative to his discovery, or that it contains more than is necessary to produce the described effect, which concealment or addition, shall fully appear to have been made for the purpose of deceiving the public, or that the thing thus secured by patent, was not originally discovered by the patentee, but had been in use, or had been described in some public work anterior to the supposed discovery of the patentee, or that he had surreptitiously obtained a patent for the discovery of another person; in either of which cases, judgment shall be rendered for the defendant with costs, and the patent shall be declared to be void."

The evidence on both sides was voluminous, tending to maintain the pretensions of the respective parties. It is not necessary here to detail it, as it was left to the Jury as the proper tribunal to decide on its weight and credibility. On the construction of the two acts of February 1793, and April 1800, a question of much importance was agitated and discussed at some length, by the

counsel concerned; whether in case the discovery should be deemed an improvement within the terms of the law, and the plaintiff considered fairly and justly the inventor of the improvement; yet, if without his knowledge, it had been known and used in a foreign country, he would be entitled to a patent from the United States? Judge Washington charged the jury particularly to this point, and went into a detailed view of both the acts of Congress, and stated it to be the best result of his opinion, that the acts did not secure to the *American inventors*, any exclusive rights, where the discovery for which they claimed a patent, was known and used (although without their knowledge) in a foreign country. The law of April, 1800, confirmed him in the opinion of the propriety of this construction. In the first section, aliens for whose benefit it was passed, are required to make oath, that the invention, art, or discovery, hath not to the best of their knowledge or belief, been known or used in *this* or any *foreign country*. The latter part of the oath is not required by citizens, for obvious reasons; but if congress had not considered the general expressions in the first section of the act of 1793, "*not known or used before the application*," extending as well to other countries as to the United States, they would not have required this additional sanction from foreigners. In England, patents are obtained under their statute of 21 James I., called the "statute of monopolies." It secures the rights to *inventors*, although the discoveries they may make, may at the time be known and used in foreign countries.* But this is in virtue of the particular wording of their statute, which is very different from the acts of congress before mentioned.

The jury found a vedict for the defendant. The counsel for the plaintiff were Moses Levy and John Read; for the defendant Messrs. Ingersoll and Duponceau.

* And this is one reason why *England is the depot of the genius of all Europe and the United States.* EDITOR.

AROMATIC SPIRIT OF VINEGAR.

THIS agreeable and pungent liquid was invented about 16 years ago by Mr. Henry, of Manchester, England. It is composed of highly concentrated vinegar, joined with the most pleasant aromatics, and may be kept unimpaired in any climate, and for any length of time. By its pungent odour, it affords relief in head-achs, and faintings; and is rendered peculiarly grateful and refreshing in crowded rooms, and in the apartments of the sick.

Many attempts have been made to imitate this vinegar, and in answer to a question in the London Monthly Magazine, as to the best way of preparing it, the following methods are given in in the No. of that work for August, 1812.

1. Pour a small quantity of concentrated sulphuric acid on the acetate of copper, (or common verdigris), the acetic acid will be plentifully disengaged, and if kept from the atmosphere will preserve its pungency for some time. By distillation at a moderate heat, the acetic acid may be procured very pure from the compound, which when scented with an odorous oil, may not prove an unpleasant substitute for the real "Henry's."

2. The method I have adopted, (says the writer) and always with success, has been to take *sal diureticus*, (acetate of postash) and to add to it gradually about half its weight of sulphuric acid; the mixture may be made in a smelling bottle. If a drop or two of bergamot, or oil of lavender, be afterwards introduced, it will constitute the present and well known perfume of aromatic vinegar.

TO MAKE RED INK THAT WILL NOT CHANGE ITS COLOUR.*

TAKE four grains of the best carmine, and pour thereon two ounces of caustic ammonia, adding twenty grains of the clearest gum arabic; let them remain until the gum is dissolved. This ink, however it may be something dearer than in the ordinary

* Tradesman, July, 1810.

way of its preparation, is of much finer colour and more durable: for by experience it is known that characters which have been traced with this ink, have remained perfectly fresh for forty years afterward.

RECENT AMERICAN INVENTIONS AND IMPROVEMENTS.

1. FILE AND SICKLE CUTTER.

MR. M. B. BELKNAP, of Worcester, Massachusetts, announces a machine for cutting Files and Sickles. It is not liable to get out of order; will cut files coarse or fine, or of any shape. One machine, with good attention, will cut from five to six dozens of 12 inch files per day. Purchasers of rights to use the machine, will be furnished with a set of machines consisting of three, calculated for cutting sickles, and the patentee will put the same in operation for him, give instructions in the art of hardening, so that the files shall have the neat appearance of the best English manufactures.

Files are now made on a large scale in Philadelphia.

2. PORTABLE WOOL SPINNERS.

THE Rev. Burgis Allison, of Philadelphia, has invented a portable machine for spinning wool, adapted to the use of private families; it is simple, and takes up but a little more room than a common wool spinning wheel. They may be constructed to drive from 10 to 15 spindles, and set to spin the yarn to any degree of fineness admitted by the wool.

Portable Spinning Billies, for wool, to carry 12 spindles, are also made by Joseph Bamford, No. 5, Filbert-street, Philadelphia, for $48. These billies spin 14 cuts to the pound, and by spinning a second time, they will turn out 20 cuts to the pound. He also makes machinery for cotton, wool, and flax for large manufactories.

3. Mill stones from the Georgia Burrs, (noticed in Vol. 2d p. 382), are now manufactured by Oliver Evans, Philadelphia,

extensively. The quality of the stone improves, the deeper the quarry is opened.

4. Messrs. Samuel B. Hitchcock and John Bennet, of Concord, (N. H.), have invented a method of pegging boots and shoes, which not only expedites the work, and relieves the workman from the necessity of sitting bent forward and drawing the wax end, by the strength of the arms, but also renders the work neater and more durable. This mode is now practised in New York, and very generally in Connecticut. The Editor has seen those pegged shoes, and can attest their neatness and durability.

A LIST OF THE NAMES OF PERSONS TO WHOM PATENTS HAVE BEEN ISSUED FROM THE TWENTY-EIGHTH OF DECEMBER, 1810, TO THE FIRST OF JANUARY, 1812.

(*Continued from p.* 104.)

Inventions in 1811.

James W. Walker, of Wilmington, North Carolina, a threshing machine, February 9.

Samuel Bacon, of Lanesborough, Massachusetts, a steam still, February 9.

Jonathan Elliot, of Newbury, Essex county, Massachusetts, an elevator for the use of the sick, February 15.

Stephen Belknap and Samuel Merrill, of Georgetown, Washington, D., a descending saw mill, February 15.

William Beach, of Franklin, Delaware county, New-York, in the double forcing pump, February 19.

Salmon Fuller, of Clark county, Indiana Territory, in propelling boats and vessels by horses, February 19.

Thomas Ferris, of Duchess county, New York, in the double forcing pump, February 20.

Thomas Paul, of Baltimore, a mode of producing what he calls Columbian oil, February 23.

Robert Lloyd Nicolls, of Easton, Talbot county, Maryland, a mode of preserving and defending wood immersed in salt water,

from the attacks or injuries of that species of worms which is generally found destructive at sea, &c., February 23.

James Stubbs and Nathaniel Parsons, of Chilicothe, Ross county, Ohio, in the steam engine called the vaporeun machine, February 25.

Miles H. Abbot, in the saw mill, February 26.

John Comfort, of Bucks county, Pennsylvania, for cutting and gathering grain and grass, February 26.

John Sweet, of Berkshire, Massachusetts, in andirons and fire places, February 26.

Elisha Perkins, of Shrewsbury, Monmouth county, N. J., in making flour, starch, and spirit, from wheat or other vegetable matter, February 26.

Ezra Willmarth, of Rumney, Grafton, Massachusetts, for shearing cloth, February 28.

William Pond, of Wrentham, Norfolk county, Mass., in manufacturing straw wove platt, February 28.

Joseph Goulding, of Leicester, Massachusetts, machine for cutting felloes for wheels, February 28.

Do. of do., in the forge and trip hammer, March 1.

Do. of do., in mills, March 1.

Townsend Cock, of New York, in training and breaking horses, March 1.

Robert Hancock, sen. and Edward W. Carr, of Philadelphia, a machine for cutting wooden screws, &c. *(a)* March 1.

Otis Paine, of Foxborough, Norfolk, Massachusetts, reverting wheels for various purposes, March 1.

Noel Blanche, of New-York, in the condensation of vapours in distillation, March 2.

Dexter Wheeler, of Bristol, Massachusetts, a tide mill wheel, March 2.

William Watson, of Weymouth, Gloucester county, N. J., in the stove, March 2.

(a) This is now in actual operation in Philadelphia.

Nehemiah Price, of Frederick county, Maryland, a machine for rubbing out clover, March 2.

Azael Pierson, of Cumberland county, New Jersey, in chain paddles for propelling boats, *(a)*, March 2.

Sherman Dewey, of Hartford, Vermont, a machine for hulling rice, March 2.

Benjamin Cummings, of Palmer, Hampshire county, Mass., for shearing cloth, March 2.

William Sheldon, jun. of Springfield, Massachusetts, in the application of slate to various uses, March 2.

Jacob Miller, of Lancaster county, Pennsylvania, in distilling, March 2.

Barzillai Russell, of Harford, Connecticut, in warming rooms, *(b)*, March 4.

George C. Killogg, of New Harford, Litchfield, Connecticut, a machine for shearing cloth, March 4.

Thomas Mussy, of Philadelphia, a water loom, March 4.

Levi Gray, of Otsego county, New York, a reverse impelling pump, being a double forcing pump, March 7.

Israel Swan, of Haverhill, New Hampshire, in planking and felting hats, March 7.

Pliny Upham, of Brookfield, Worcester, Massachusetts, in the pump for raising water, March 9.

Samuel Randall, of Providence, Rhode Island, the subignis air draught, March 12.

George Neff, of Dauphin county, Pennsylvania, a machine for cutting sausage meat, &c., March 19.

Abraham Quincy, of Boston, a fire cavern, March 20.

(a) This is not yet applied to any use.

(b) Mr. Russell's contrivance is very simple, and economises fuel. By it a current of hot air, which in common chimneys ascends with the smoke, and is lost, is brought out above the mantle, and diffuses a pleasant warmth through the room. The principle of admitting hot air into rooms has been adopted in various ways for a century past; but Mr. Russell's mode is new, and certainly very effectual. It is in use at the Rev. Dr. Allison's, South Eighth-street, who is the agent of the patentee for Philadelphia. *Editor.*

Peter Sternberg, of Montgomery county, New York, in fire places, March 20.

Luther Gale, of Berkshire county, Massachusetts, a bark mill, March 20.

Daniel Van Voorhis, of Long Island, New York, a horizontal bellows wind wheel, which by reversing the wheel may be applied to water, March 21.

Lyman Cook, of Whitestown, Oneida county, New York, in the condenser, March 26.

Harry Mumford, of Ulster county, N. Y., a churn, March 28.

Rulef C. Van Houton, of New-York, a threshing machine, March 28.

Lyman Cook, of Whitestown, Oneida county, New York, in four-wheel carriages to be moved by manual labour, March 28.

John Boynton, of Windham county, Connecticut, for straining and grinding cards, March 30.

Cyrus Alger, of Boston, a mode of casting large iron rollers for rolling iron, &c., March 30.

Abiather Eastman, of Norway, Oxford county, Massachusetts, a nail machine for making wrought nails and spikes, or drawing small iron into any form, April 8.

William Baley, of Nelson county, Kentucky, a stave and shingle machine, April 10.

John Morgan, of Philadelphia, in the form of cossack boots, or rather in the mode of cutting leather for the formation of boots of every description, April 10.

Joseph Barker, of Deerfield, Oneida county, New York, in tanning leather, April 10.

Erastus V. Freeman, in making gin, April 10.

Jacocks Swain, H. Swain, and Joshua Swain, of Cape May court-house, in the lea board, April 10.

Oliver Evans, of Philadelphia, in saw mills, *(a)*, April 15.

Joseph Bernard, of Troy, New York, for vibrating nail plates while cutting, April 16.

(a) This is to regulate the feed of the saw, and is coming into use. *Editor.*

William Gamble, of Washington City, Columbia District, in distilleries and kitchen ranges, April 18.

Shubael Kimball, of Rhinebeck, Duchess county, New York, a lever purchase machine for propelling boats, working mills, &c., April 24. *(a)*.

John F. Randolph, of New York, a floating machine for supplying ships with fresh water, April 25.

Andrew Sherwood, of New York, in the kitchen stove, April 25.

Jeremiah Sibley, of New York, for cramping Suwarrow boot legs, April 25.

Andrew Sherwood, of New York, the drum cooking stove, April 25.

Benjamin Schoolfield and William Stanton, of Lynchburg, Campbell county, Virginia, in the spiral water wheel by balance gates, April 25.

Daniel Atherton, of Providence, Rhode Island, for trimming and pressing straw plait, April 26.

Edward Rumsey, of Christian county, Kentucky, a flax and hemp break, April 26.

Jesse Molleneux, of Hempstead, New York, for shearing cloth, April 30.

Eleazer Hovey, of Canaan, Columbia county, New York, a shearing machine, *(b)*, May 2.

Samuel Stone, of Enosburg, Franklin county, Vermont, for rasping or sawing dye woods, May 3.

Daniel Robinson, of Franklin, Delaware county, New York, a churn, May 3.

Andrew Dunlap, of Boston, in distilling, May 3.

Mark Andrews, of Kennebec, Mass., a mode of working a water wheel by raising and lowering it in a current or tide, May 4.

James Gregg, of New Hampshire, in manufacturing bricks, May 7.

(a) This plan has totally failed.

(b) The Editor saw this in operation : it shears one yard in a minute perfectly well. The manufactory of them is at New Lebanon, New York. *Editor.*

John Rewey, of Berkshire, Broome county, New York, machine for cutting off the ends of bolts, &c., May 8.

Ebenezer Avery Lester, of Herkimer, New York, a vertical balance wheel nail-cutting machine, May 8.

Thomas Armat, of Philadelphia, for weighing hay, live cattle, &c., *(a)*, May 10.

Edward Gibson, of New York, in the bodies of carriages called the standing roof landau, May 10.

Ezra L. Miller, of Charleston, South Carolina, a writing instrument, May 11.

John James Jiraud, of Baltimore, a perpetual steam still, May 15.

John C. Johnston, of Fayette county, Kentucky, in breaking hemp and flax, May 16.

William Thornton and John Hatkill, of Washington City, in fire arms, May 21.

John Stephens, of New York, in constructing steam engines for propelling boats, May 21.

John Ballthrope, a spring for fastening window sashes, May 22.

David Dungan, of Upperville, Loudon county, Virginia, a washing machine, May 23.

Marshall Lewis, of Chenango, Broome county, New York, in saw mills, May 24.

Charles Woolverton and Benjamin Ridgway, jun'r. of Morris Villa, Pennsylvania, a machine for dressing mill stones, May 24.

Henry Burke, of Bucks county, Pennsylvania, in suspenders, &c., May 25.

Heman Palmerler, of Shoreham, Addison county, Pennsylvania, in the carding machine, May 25.

Joshua Witherle, of Boston, in cutting fur from peltry, May 28.

John Osborn, jun'r. of Litchfield, Connecticut, a horizontal water wheel, May 29.

Benjamin Wolcot, of Danbury, Huron county, Ohio, being a double suspender spring, May 29.

(a) This is in operation at Germantown, Philadelphia county. *Editor.*

Daniel Parker and John Sanford, of Sharon, Litchfield county, Connecticut, machine for shaving shingles, &c., May 30.

Vincent King and Jeremiah King, of Belleair, Harford county, Maryland, in working certain ores, May 30.

Joseph Ruggles, of New Milford, Litchfield county, Connecticut, a water blast, June 6.

Luther Bissel, of Ostego county, New York, in sawing and polishing marble, June 7.

Luke C. Hinman, Luther Bissel and Moses Barnes, of Ostego county, New York, a machine for moving two water wheels at the same time, May 7.

Harvy Bascom, of Weston, Massachusetts, a composition for mending china glass, &c., June 10.

William Stillman, of Westerly, Rhode Island, in shears for shearing woollen cloth, June 11.

Samuel Smith, of Herkimer county, New York, in the steam kitchen for baking, &c. &c., June 11.

Abner Ellis, of Dedham, Norfolk county, Massachusetts, in chair bottoms, June 12.

John James Giraud, of Baltimore, in distilling, June 14.

Jacob Sherer and Abraham Killian, of Lancaster, Pennsylvania, a distilling and refining apparatus, June 17.

Thomas W. Jessup, of Fredericktown, Maryland, a fanning mill for cleaning grain, June 18.

Barnabas Langdon and William Mowry, of Washington county, New York, machine for shaving, jointing, and forming the staves and heads of barrels, &c., *(a)*, June 20.

Josiah Noyes, of Herkimer county, New York, a steam stove for roasting, boiling, and baking, June 21.

John George Baxter, of Philadelphia, the family cotton spinning machine, *(b)*, June 22.

Joseph Lyon, of Philadelphia, in preparing and packing quercitron or black oak bark, or other barks, for exportation, July 1.

(a) This is in operation at White-hall, New York.

(b) This has not yet been brought into use. *Editor.*

Jonathan Jessop, of York Town, Pennsylvania, a balance bridge, July 1.

Christian Bergh and Peter Shermerhorn, jun'r., of New York, for spinning and winding rope yarn, July 2.

Charles M'Murtry, of New Marlborough, Massachusetts, in the forge bellows, July 8.

Robert Miller, of Lexington, Kentucky, for breaking hemp and flax, July 13.

Allen Harrington, of Ostego county, New York, in medicine cases, July 16.

John Staples, of Richmond, Virginia, a pendulum steam engine, July 18.

John Hughson, of Clinton county, New York, in kilndrying corn and malt, &c., July 18.

Haziel Smith, of Philadelphia, a machine for chopping meat or any other substance fine, *(a)*, July 19.

Archelaus Putnam, of Philadelphia, an improved accelerating wheel head, July 20.

Leonard Sommer, of Downington, Chester county, Pennsylvania, in horizontal wooden springs for carriages, *(b)*, July 22.

Jacob A. Dana, of Casanovia, Madison county, New York, a flax and hemp break, July 23.

Jonathan Righter, of Downington, Chester county, Pennsylvania, a machine for making sacket and sand shovels, July 23.

Richard Sealy, of Newark, New-Jersey, in the still and condenser, July 25.

William Hollingsworth, of Elkton, Maryland, in tanning, July 30.

Samuel B. Hitchcock and John Bement, of Homer, Cortland county, New York, in boot and shoe making, July 30.

Hawley Emmerson, of Hancock, a wear for catching fish, August 14.

(a) Where meat is cut up on a large scale, this contrivance will greatly diminish labour.

(b) These springs are fixed to the Lancaster stage carriages, and to other stages, and are much approved of. *Editor.*

Jesse Reed, of Kingston, Plymouth county, Massachusetts, in cutting and heading nails, August 14.

William Miller, of Lampeter township, Lancaster county, Pennsylvania, in mill stones, August 15.

Michael Morrison, of Boston, for picking wool, &c. called the wool picker, August 15.

William Gorsuch, of Baltimore, a perpetual lime kiln, August 17.

Bennet Lies, of New York, in the sea motion pump, August 19.

John Sanford, of Sharon, Litchfield county, Connecticut, in varying the motion of a plough, August 20.

Nathaniel Miller and Philip W. Miller, of Franklin, Norfolk county, Massachusetts, in weaving, August 20.

Charles Reynolds, of East Windsor, Connecticut, a mode of propelling carriages by steam, August 21.

Robert Hare, of Philadelphia, a mode of ripening and keeping malt liquor and cider, *(a)*, August 22.

David F. Launey, of Philadelphia, in the electrophorus, August 23.

Abraham Lands, of Georgetown, Columbia District, in the water wheel, August 28.

Theodore Hart, of New York, a double spring angular truss, August 30.

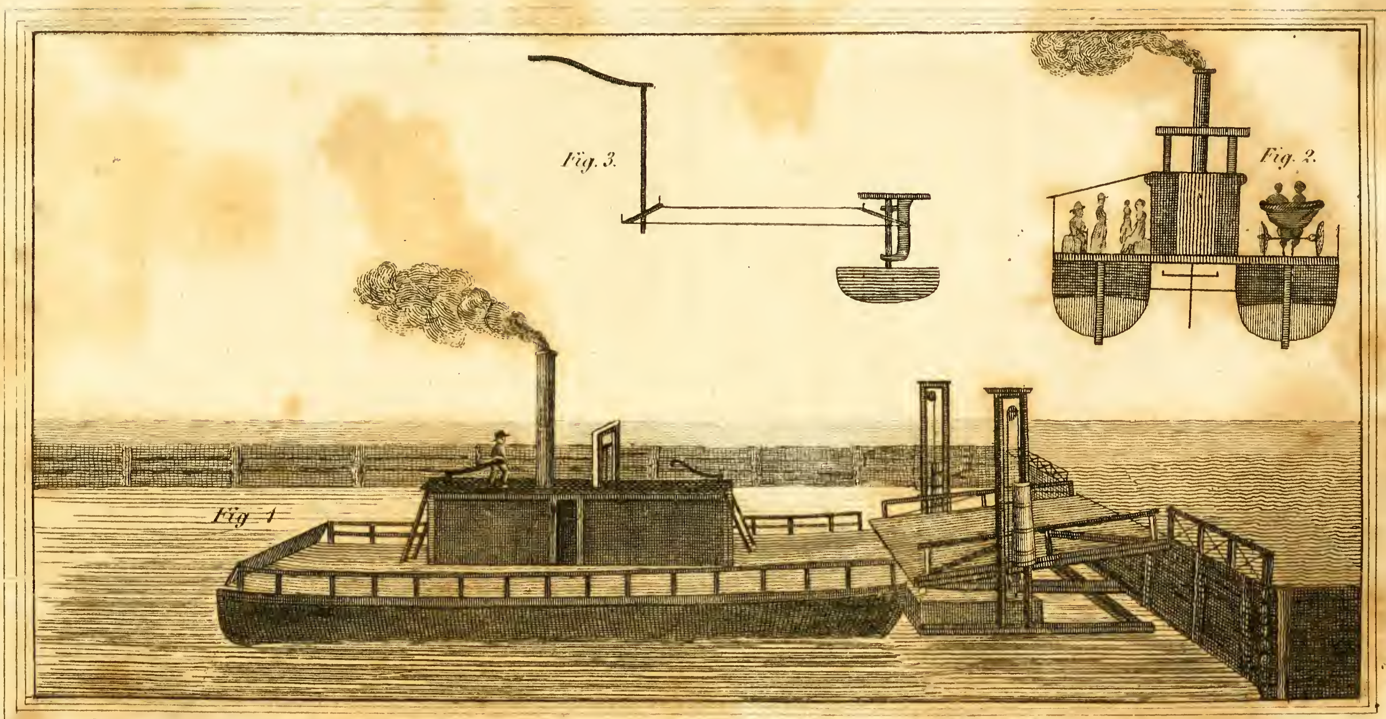
Andrew Henshaw and Nathaniel Harlow, jun'r. of Banger, Hancock county, Massachusetts, in constructing and working pumps for the use of ships, &c., August 30.

(a) The patentee states that malt liquor and cider may be kept on draught in the patent casks as ripe as in bottles, and may be preserved without vent, during transportation, in the warmest weather, by sea or land. They are of various sizes. The smallest holds about as much as three and an half dozen porter bottles, the middle size five and a half dozen, and the largest eleven dozen.

By means of a pipe, annexed by a simple contrivance, the liquor will spontaneously mount into a bar room, and being received in a keg furnished with a vessel for holding ice, may be drawn at pleasure, cool and foaming.

This improvement is now in operation in Philadelphia, in various taverns.

Editor.



Fulton's Steam Ferry Boat.

Engrav'd for Archives of Useful Knowledge.

ARCHIVES

OF

USEFUL KNOWLEDGE.

VOL. III. JANUARY, 1813. No. 3.

PAPERS ON COMMERCE.

THE PAULUS HOOK STEAM FERRY BOAT.

(With a Plate.)

THE danger and inconvenience of the ferry across Hudson's river, from New-York to Jersey city, has been sensibly felt by all who were necessitated to pass by that route, which is one of the most frequented from Maine to Georgia. In head winds and strong tides, it has often required three hours to make the passage, and in a calm it has been next to impossible to get over such a boat as would be able to take a horse and carriage. Even under the most favourable circumstances, the risque and inconvenience of putting a carriage and horses into a sail boat, was daily experienced, and the passage of the Hudson pressed like a load on the mind of the traveller who was under the necessity of crossing it. A bridge in this situation is rendered impracticable, in consequence of the width of the river, the depth of the water, expense of construction, and the injury which it would cause to the navigation. But, happily, a novel work of art has removed all those difficulties: Mr. Fulton has constructed a Steam Ferry Boat, the complete success of which seems to give every advantage which could be expected from a bridge, at least during the

time the river is free from ice, which in this place is usually ten and a half or eleven months in the year; and thus greatly facilitates the *commercial intercourse* between the Northern and Southern states.

The annexed engraving is a perspective view of the Boat, and the floating bridge, by which passengers, carriages, horses, &c., enter or land from her.* "She is a combination of two boats, each 10 feet beam and 80 feet long, separated 10 feet, and fastened in that position with strong beams and braces, forming a deck 80 feet long, and 30 feet wide, which breadth of beam gives stability in crossing the river through the trough of the waves. Between the two boats the water-wheel is placed, where it is guarded from all injury; and over the open space between the two boats, on strong timbers, the boiler, engine, and whole machinery are placed, which leaves 10 feet space on each side for passengers, carriages, horses, cattle, &c. One side is appropriated to carriages, horses, &c.; the other, as in figure 2d, has neat benches, and is covered with an awning for the convenience of passengers: on this side there is also a cabin, capable of containing 100 persons, where they can take shelter in boisterous or rainy weather, or from the cold of winter. There is a rudder at each end of the boat, and in a right line between the two boats; having the rudder post (which is of wrought iron) exactly in the middle, and being thus equally balanced from the centre, they can go either end foremost. The rudder, its yokes, parallel rods, &c., which carry its movements to the tillers on deck, as in figure 1st, are represented figure 3d. In this manner the boat never puts about; and thus, as carriages and horses enter at New York, their heads towards Jersey, they go out at the other end of the boat, without changing their line of direction, which is a great convenience, and saving of time. For the convenience of landing from, or entering the boat, there is a bridge, one end of which is fastened by hinges to the inner bulk head of a dock, and the other end is fastened by hinges to a coffer which floats on the water, by which

* For the drawing and following description of the boat, the editor, at his request, was favoured by the ingenious inventor.

means the bridge rises and falls with the tide, and is always exactly even with the end of the boat. The dock in which the boat enters, is 180 feet long, and 70 feet wide, giving 20 feet on each side of the boat within the dock, in which spaces there are frames of floating logs running parallel to the sides of the boat about 30 feet, and then diagonally to the extreme end of the wharves, so that if the boat hits within the 70 feet, at the end of the dock, these guiding logs leave her no other place to go to, except directly to the bridge. To prevent her striking the bridge with a shock, there are two timbers, each about 8 inches square, projecting from the coffer about 10 feet, and running on rollers; these timbers are connected by ropes, with two long vessels in the form of churns, the weight of which, when descending into the water, pushes the limbers out 10 feet, the vessels are then immersed, and full of water: when the boat arrives and strikes the timbers, they are pushed in towards the bridge, and raise the buckets full of water, which buckets, in rising out, become gradually heavier and increase resistance to the boat, until her momentum is annihilated, and she arrives at the bridge without shocks; the passengers then land, and others enter as from or on a bridge."*

This boat can carry at one time from 6 to 10 carriages, and 300 persons, and usually crosses the river, which is 1½ miles wide, in from 14 to 19 minutes. In July last a corps of flying artillery crossed in the boat from Jersey to New York, on its way to Albany, at four trips; in the first of which it brought 4 pieces of artillery (6 pounders,) and timbers, 4 ammunition wagons, 27 horses, and 40 soldiers, besides other passengers; and since that time a much larger freight of the same kind has been taken over.

Of all the works of art, this boat approaches nearest to the convenience of a bridge, and at the place where it plies, it is superior to a bridge, as it does not impede navigation.

* This contrivance to direct the boat to the end of the bridge, is extremely ingenious, the actual operation of which will be viewed by every admirer of mechanism with great pleasure. *Editor.*

By the company's contract with the corporation of New York, the establishment is to consist of two boats, so that one may leave each side of the river every half hour. While this useful invention opens an easy communication between the citizens of New York and Philadelphia, its benefits will extend to many parts of the United States, where, either from natural difficulties, or expense, bridges are impracticable. The Susquehanna, at Havre de Grace, may be mentioned as one place where such a steam ferry boat would be highly important.

DESCRIPTION OF A CAPSTAN,

Which works without requiring the Messenger or Cable coiled round it to be ever surged. By J. Whitley Boswell, Esq. of Clifford's inn.*

SIR,

I REQUEST you will lay before the Society of Arts, &c. the model of a capstan contrived by me, which works without requiring the messenger or cable coiled round it to be ever surged, an operation necessary with common capstans, which is always attended with delay, and frequently with danger. Capstans of this kind can be made by a common shipwright, and would not be liable to be put out of order. They also would not occasion any additional friction or wear to the messenger or cable, in which particulars they would be superior to the other contrivance hitherto brought forward for the same purpose; they also would much facilitate the holding on.

The great loss of time and great trouble which always attends applications to the Navy Board, prevent my attempting to bring the matter before the public through that channel, though I have had the most unequivocal approbation of the capstan from the two gentlemen of that board best qualified to judge of it. I mention this, least it might be thought that my not applying there first

* From the Transactions of the Society of Arts, London, Vol. 26. The Gold Medal of the Society was presented to Mr. Boswell, for this communication.

was from any doubt of the goodness of the invention. If the Society should approve of the capstan, I will draw up a more minute account of it for publication.

I am, Sir,

Your very humble servant,

Hatton Garden, Oct. 29, 1806.
To C. TAYLOR, M. D. SEC.

J. W. BOSWELL.

SIR,

I HAVE examined your model of a Capstan, which is calculated to prevent the surging of the messenger when heaving in the cable; it certainly possesses great merit, and the idea to me is quite new.

I am, Sir,

Your humble servant,

Somerset-place, Nov. 19, 1806.
To MR. BOSWELL.

WILLIAM RULE.

SIR.

ACCORDING to your desire, I transcribe the part of the letter from Mr. Peake (Surveyor of the Navy) to me, which relates to the capstan laid before the Society.

Extract of a Letter from Henry Peake, Esq.

"With regard to your ideas on the capstan; I have tried "all I can to find some objection to it, but confess I hitherto "have been foiled, and shall more readily forward it, if it was "only to supersede a plan now creeping into the service, more "expensive, and much worse than one lately exploded."

As you and the members of the Committee have seen the letter, I imagine further attestation needless relative to it.

I request you will mention, that all friction of the revolutions of the cable (or messenger) in passing each other between the barrels of the capstan, must be effectually prevented by the whole thickness of one of the rings that passes betwixt each crossing.

I add this because one of the gentlemen of the Committee wished to be informed on this point.

I am, Sir,

Your very respectful humble servant,

J. W. BOSWELL.

Hatton Garden, Nov. 26, 1806.

To C. TAYLOR, M. D. SEC.

SIR,

IN obedience to your intimation, that a written explanation of the advantages to be obtained by the use of capstans made according to the model, which I laid before the Society for the Encouragement of Arts, &c. would be acceptable, I send the following, which I hope will make the subject sufficiently clear.

As few but mariners understand the manner in which cables are hauled aboard in large ships, it will probably render the object of my capstan more manifest, to give some account of this operation.—Cables above a certain diameter, are too inflexible to admit of being coiled round a capstan; in ships were cables of such large dimensions are necessary, a smaller cable is employed for this purpose, which is called the *messenger*, the two ends of which are made fast together so as to form an endless rope, which, as the capstan is turned about, revolves round it in unceasing succession, passing on its course to the head of the ship, and again returning to the capstan. To this returning part of the messenger, the great cable is made fast by a number of small ropes, called nippers, placed at regular intervals; these nippers are applied, as the cable enters the hawse hole, and are again removed as it approaches the capstan, after which it is lowered into the cable tier.

The messenger, or any other rope coiled round the capstan, must descend a space at every revolution, equal to the diameter of the rope or cable used; this circumstance brings the coils in a few turns to the bottom of the capstan, when it can no longer be turned round, till the coils are loosened and raised up to its other extremity, after which the motion proceeds as before. This operation of shifting the place of the coils of the messenger on the

capstan, is called *surging the messenger:* It always causes considerable delay; and when the messenger chances to slip in changing its position, which sometimes happens, no small danger is incurred by those who are employed about the capstan.

The first method that I know of, used to prevent the necessity of surging, was by placing an horizontal roller beneath the messenger, where it first entered on the capstan so supported by a frame, in which it turned on gudgeons, that the messenger in passing over it was compelled to force upwards all the coils above the capstan, as it formed a new coil.

This violent forcing of the coils upwards along the barrel of the capstan, not only adds considerably to the labour in turning the capstan, but from the great friction which the messenger must suffer in the operation, while pressed so hard against the capstan, (as it must be by the weight of the anchor and strain of the men,) could not but cause a very great wear and injury to the messenger, or other cable wound round the capstan; and that this wear must occasion an expense of no small amount, must be manifest on considering the large sums which the smallest cables used for this purpose cost.

The next method applied to prevent surging, was that for which Mr. Plucknet obtained a patent, the specification of which may be seen in the Repertory of Arts, No. 46: In this way a number of upright puppets or lifters, placed round the capstan, were made to rise in succession, as the capstan turned round by a circular inclined plane placed beneath them, over which their lower extremities moved on friction wheels, and these puppets, as they rose, forced upwards the coils of the messenger on the barrel of the capstan. This was a superior method to the first, as the operation of forcing upwards the coils, was performed more gradually by it; but still the wear of the messenger from the lateral friction in rising against the whelps of the capstan remain undiminished.

The third method used for the same purpose, was that proposed by captain Hamilton. It consisted in giving the capstan a conical shape, with an angle so obtuse, that the strain of the mes-

senger forced the coils to ascend along the sloped sides of the barrel. The roller first mentioned was sometimes used with this capstan, of which a full account is inserted in the Repertory of Arts, vol. 2. The lateral friction, and wear of the messenger against the whelps of the capstan, is equally great in this method as in the others; and it, besides, has the inconvenience of causing the coils to become loose as they ascend; for as the upper part of the barrel is near a third less in diameter than the lower part, the round of the messenger that tightly embraced the lower part, must exceed the circumference of the upper extremity in the same proportion.

In the method of preventing the necessity of surging, which the model I have had the honour of laying before the society represents, none of the lateral friction of the messenger or cable against the whelps of the capstan, (which all the other methods of effecting the same purpose before-mentioned labour under,) can possibly take place, and of course the wear of the messenger occasioned thereby will be entirely avoided in it, while it performs its purpose more smoothly, equally, and with a less moving power than any of them.

My method of preventing the necessity of surging consists in the simple addition of a second smaller barrel or capstan of less dimensions to the large one; beside which, it is to be placed in a similar manner, and which need not in general exceed the size of an half-barrel cask: The coils of the messenger are to be passed alternately round the large capstan and this small barrel, but with their direction reversed on the different barrels, so that they may cross each other in the interval between the barrels, in order that they may have the more extensive contact with, and better gripe on each barrel. To keep the coils distinct, and prevent their touching each other in passing from one barrel to the other, projecting rings are fastened round each barrel, at a distance from each other, equal to about two diameters of the messenger and the thickness of the ring. Those rings should be so fixed on the two barrels, that those on one barrel should be exactly opposite the middle of the intervals between those on the other

barrel: and this is the only circumstance which requires any particular attention in the construction of this capstan. The rings should project about as much as the cable or messenger from the barrels, which may be formed with whelps, and in every other respect, not before-mentioned, in the usual manner for capstan barrels, only that I would recommend the whelps to be formed without any inclination inwards at the top, but to stand upright all round, so as to form the body of the capstan in the shape of a polygonal prism, if the intervals between the whelps are filled up, in order that the coils may have equal tension at the top, and at the bottom of the barrels, and that the defect which conical barrels cause in this respect may be avoided.

The small barrel should be furnished with falling palls as well as the large ones; a fixed iron spindle ascending from the deck will be the best for it, as it will take up less room. This spindle may be secured below the deck, so as to bear any strain, as the small barrel need not be much above half the height of the large barrel; the capstan bars can easily pass over it in heaving round, when it is thought fit to use capstan bars on the same deck with the small barrel. As two turns of the messenger round both barrels will be at least equivalent to three turns round the common capstan, it will hardly ever be necessary to use more than four turns round the two barrels.

The circumstance which prevents the lateral friction of the messenger in my double capstan, is, that in it each coil is kept distinct from the rest, and must pass on to the second barrel, before it can gain the next elevation on the first, by which no one coil can have any influence in raising or depressing another; and what each separate coil descends in a single revolution, it regains as much as is necessary in its passage between the barrels, where in the air, and free from all contact with any part of the apparatus, it attains an higher elevation without a possibility of friction or wear.

I have described my double capstan, as it is to be used in large vessels, where messengers are necessary, from the great size of the cables; but it is obvious that it is equally applicable in smaller

vessels, as their cables can be managed with it in the same manner as is directed for the messenger. The same principle may also be easily applied to windlasses, by having a small horizontal barrel placed parallel to the body of the windlass, and having both fitted with rings, in the same way as the capstan already described. The proper place for the small horizontal barrel is forward, just before the windlass, and as much below its level as circumstances will admit; it should be furnished with catch-palls as well as the windlass.

Besides the advantages already stated, my proposed improvement to the capstan has others of considerable utility. Its construction is so very simple, that it is no more liable to derangement or injury than the capstan itself. Its cost can be but small, and every part of it can be made by a common ship carpenter, and be repaired by him at sea if damaged by shot. It will take up but little room, only that of an half-barrel cask; and it is of a nature so analogous to that kind of machinery to which sailors are accustomed, that it can be readily understood and managed by them.

In order to render the description of my double capstan more clear, I annex a sketch of it, as fitted up in the manner proposed.

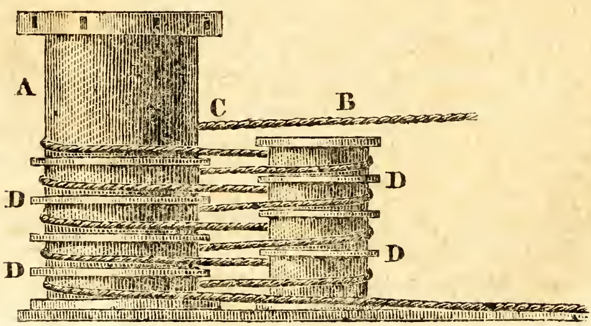
I am, Sir,

Your very respectful humble servant,

J. WHITLEY BOSWELL.

To C. Taylor, M. D. Sec.

Reference to the Cut of Mr. Boswell's improved Capstan, to prevent the necessity of surging.



A Represents the larger or common capstan used on board ships.

B Another capstan of less dimensions, placed in a similar manner.

C The coils of the messenger passing alternately round the large and small capstans, but with their direction reversed on the different barrels, so that they may cross each other in the interval between them.

D D D D Projecting rings round each capstan or barrel, so fixed on the two barrels, that those on one barrel should be exactly opposite the middle of the intervals between those on the other barrel.

ACCOUNT OF THE MEANS

Which have been used with success, in obviating the effects of

HUNGER, COLD, AND THIRST, AT SEA.

The following observations constitute part of an introduction to a very interesting Narrative of the hardships which Mr. David Woodard, and four seamen suffered, while in a boat at sea.*

THE conclusions to be drawn from this narrative and collection, and from all voyages connected with this subject, are interesting and important to society, and form, as it were, a NEW ERA in navigation, in cases of dangers and disasters. No history can be more interesting and instructing to man, than that of man, and the events that befall him. A creature of every passion, and of every clime, the events of his life produce the strongest contrasts of light and shade, which are for ever varying, and for ever new. Prosperity and adversity, hope and despair, often form the great leading features of his life; and nothing but perseverance, and a well-grounded trust in Providence, can preserve him through all his difficulties and dangers. In no situation have the shades, or the hopes, enterprises, and the objects of life, been

* The narrative was published by Mr. Wm. Vaughan, London, 1806.

more varigated or chequered than in voyages of discovery, colonisation, and commerce; and the histories of those men who have escaped shipwrecks and hardships have ever been read with the greatest compassion and the most lively interest, from the dangers that have been encountered, and the perseverance, forbearance, and substitutes, which have been dictated by necessity. The school of adversity has often called forth all the powers and faculties of the mind and body of man through fatigue and hunger, and all the storms and shipwrecks that await him; and he at last survives them, and reaches his native shore, to relate those adventures that prove the wisest lessons and consolations to his own mind, and the strongest examples for conduct to others.

Misfortunes, if rightly applied, may prove useful sources of knowledge. The respective narratives of captains Inglefield, Bligh, and Wilson, cannot be read without emotion and instruction, because they relate to events that reach men's homes and bosoms; and, in proportion as commerce expands upon an extensive scale, and forms one of the greatest links to civilisation, and has a tendency to increase the union of nation to nation, accidents and escapes are worth recording, from the knowledge they convey, and the examples they produce.

They plainly show, that hope, perseverance, and subordination, should form the seamen's great *creed* and *duty;* as they tend to banish despair, encourage confidence, and *secure* preservation.

The examples of the conduct of men sustaining hunger, thirst, and fatigue, for a length of time, almost without food, beyond its taste, or on the division of a biscuit and a glass of water, or of spirits, have frequently, under given circumstances, produced miraculous escapes; whereas despondency, insobriety, and insubordination—qualities that canker hope and induce vexation —have often proved the seeds or secret springs of mutiny and disaster; and occasioned the loss of lives and of ships, under circumstances the most calamitous and the most afflicting.

As the great fact of the powers of ABSTINENCE for a length of time, both at sea and on shore, is so fully established in the annexed documents, the next consideration is to endeavour to regulate a little the conduct of men in such trying situations.

In moments of difficulty and danger, where the remedies at command are few, patience and perseverance are necessary; and, under them, men of vigorous minds frequently overcome the greatest obstacles. It is not always possible to prescribe rules of conduct in cases that must, in general, form their own rules; but a great deal may be done by management and good conduct, to alleviate sufferings and distresses.

As there is a strong affinity between the powers of the mind and body to support each other under great conflicts, officers and men should so temper obedience and command, as to create confidence and union in each other for self-preservation. In these moments, when the impressions of religious feelings are always the strongest, their sensations should be encouraged, from the tranquility of mind and consolations they produce, the hopes they encourage, and the exertions they create.

Another object is the great importance of temperance, of union and subordination, and the keeping together without separation. The want of these has frequently been as fatal and destructive in its consequences, as the want of food itself.

The conduct of the crew of the Pandora after their shipwreck, on their returning home with some of the mutineers of the Bounty sloop, on board of four boats, until their arrival at the island of Timor; and the narratives of captains Inglefield, Bligh, Wilson, and others, are strong exemplifications of the good effects of union and perseverance; and form fine contrasts with the fate of the crew of the Wager, captain Cheap, one of commodore Anson's fleet, lost in the South Seas in the year 1740,* as collected from the four different accounts of the several routes which her men took, and the few that ever reached England; and affording a melancholy proof of the effects of that inebriety, insubordination, and spirit of mutiny, which prevailed amongst them, and which

* Wrecked on an uninhabited island. Eighty-one persons embarked in the long Boat: of whom thirty arrived in four months at Rio la Grande, after many deaths and great hardships.

occasioned most of the disasters and hardships they encountered.*

I have heard captain Wilson relate, that when his ship was wrecked off the Pelew Islands, he greatly owed his preservation, the facility of building his vessel, and the good understanding that existed with the natives, to the staving of his spirits, the good order and discipline of his men, and to their residence on an island by themselves without much intercourse with the natives of Pelew, unless by occasional direct visits between captain Wilson and officers and the chiefs of these islands.

Advantages might be derived from a proper attention to the *management of clothing*, and the keeping the body as much as circumstances will permit in an equal state of warmth, so as to suffer as little as possible from the transitions or fluctuations of wet, cold, and air. It has been also found that warmth of clothing has frequently had a happy tendency to lessen the sensations of hunger, and to prevent colds and disorders incident to checked perspiration. Where there has been a scantiness of clothing, warmth has been often produced by keeping clothes tight round the body; and also by tying a handkerchief, or linen, round it, after the Indian fashion. Men, by rubbing themselves and each other when wet, cold, or benumbed, have often produced warmth and an increased circulation, when the body has been reduced to a languid state.

Captain Kennedy's narrative of himself and his crew, and of his subsequent distresses in an open boat for fourteen days, is peculiarly interesting, and written by a man of great intelligence and observation. He expressly states, that he and his men derived great advantage from soaking their clothes twice a-day in salt water, putting them on without wringing them; and that he imputed the preservation of his own life, and the lives of six others who survived their hardships of hunger, thirst, and cold,

* It was in consequence of the misconduct of the crew of this ship, and the conception that on the loss of a ship in the navy, all power and controul on such occasions ceased, a bill passed through parliament to put officers and men in the navy under the mutiny act.

to this precaution; and that he took the hint from a treatise of Dr. Lind's, which, he says, should be read by all sea-faring men. He also remarks, that four out of the six, who drank large quantities of salt water, grew delirious, and died; but that those who avoided it had no such symptoms.

Captain Bligh and others have also practised and strongly recommended, the same system of wringing their clothes out when wet with rain, and the dipping them in salt water; and state that they felt a benefit and change more like that of dry clothes, from its producing a refreshing warmth, than could have been imagined.

Men, particularly when in boats, are often exposed to be wet through from waves and the spray of the sea; but this inconvenience, when compared with greater evils or misfortunes, may not be without its consolations or advantages, as it is observed that men suffer less when seated in salt water, than when more elevated, and exposed to rain and to chilling winds. A blanket or a bit of a sail at their backs, the same over their knees, will often give great shelter to men, from cold, or the draughts of wind, when wet through.

If seamen on boat duty, and on night excursions, or on escaping from shipwrecks, were to wear flannel next to their skin, or were to put on double clothing, or two or three shirts, they would find a benefit and great warmth: and in case of separation from ships, or in shipwrecks, still greater advantages might be derived from this measure in moments of necessity, from their increasing their comforts, and furnishing the means, perhaps, of giving sails in moments of distress.*

The bailing of water out of boats will also tend to give em-

* When captain Woodard was questioned in what manner a boat should be equipped on quitting her ship at sea, he stated, that he should, to guard against accidents, recommend her having a compass, glass, boat-hook, and axe; a hammer, nails, tinder and box, knives, and a boiler or kettle; a gun, fishing-tackle, rope, and spare sail; their biscuits and water to be in kegs; some tobacco, money, and a bottle or two of brandy or rum: a boat-cloak, and, if convenient, a spare plank. That with these a boat's crew would survive many a storm and much distress.

ployment to mind and body, as well as warmth from exercise. Relief may be found from chewing or smoking tobacco, both as to warmth, and as a substitute to lessen the sensations of hunger. Seamen being so habituated to this article, it would be found peculiarly advantageous were it to form a part of their little stock on these occasions.

It has been generally observed, that the cold from fresh water is more difficult to be supported than from sea water; and doctor Currie, a physician of considerable practice at Liverpool, in a work on the application of warm and cold water as a remedy in fevers, confirms this leading fact.

He speaks, also, of a remarkable case of the shipwreck of an American vessel, near Liverpool, on the 13th of December 1790, where two of the crew, out of fourteen, died from the external and alternate exposure of air and water, both salt and fresh; that others, who were more plunged in the sea, survived, one excepted, who died, at a later period, of despondency. The one who suffered the least was a black, who was covered to the shoulders in the sea. The temperature of the sea was 35°, and that of the air still lower; and attended during part of the time with sleet, snow, and a piercing wind, which might have affected the men more than salt water. The stay on the wreck was twenty-three hours. The two who died first were delirious: none were drowsy; but all were thirsty and hungry. Mr. Amyat the mate, who related the story, had his hands and feet swelled and benumbed: but he was not senseless; his mouth was parched, and he felt a tightness at the pit of his stomach, with distressing cramps on his sides and hips. The conclusion drawn by doctor Currie* was, that pure water on the surface of the body was more hurtful than that of sea water. This induced him to make some experiments on the effects of immersion in fresh and in

* Doctor Currie's valuable book on fevers first appeared in the year 1798. It has been reprinted, in two volumes, with very considerable additions, and is well worthy the attention of medical and of nautical men; proving the great benefits that have been derived, in many countries, by the experiments that have been made on this subject.

salt water, of an equal temperature, on the animal heat, or on the capacities of bodies to preserve the same degree of heat under different circumstances. He has also found that bathing, or throwing salt water over the body at sea; and salt water, or fresh water saturated with salt, on shore; have frequently in many fevers reduced their virulence, when they have not yielded to medicine.

I believe, in the case of the Apollo frigate, lost off the coast of Portugal on the 2d of April 1804, this fact was unfortunately confirmed, on a more extensive scale than in the preceding instance of the ship at Liverpool; it being found that numbers perished who were exposed to the alternate effects of rain and air; and that many survived who were covered or more immersed in salt water.

Sleep should be encouraged, as one of the greatest restoratives of nature, and from its being essentially necessary for the daily preservation of health and spirits. Nothing exhausts the human frame so much as the want of it; particularly when worn down with fatigue, hunger, and distress.

Intenseness of thought, and great agitation of mind, produce restlessness, watchfulness, and despondency; and, if too much indulged, or of too long continuance, are followed by fevers and deliriums that end frequently with the most fatal consequences. Nothing can be more destructive to life, or to perseverance, than permitting the depression of the mind or spirits.

Captain Fellowes, in his interesting narrative of the loss of the Lady Hobart packet, states naturally* the effects of despondency and delirium in the case of a poor French captain, who, in the height of his disorder, threw himself overboard, and instantly went to the bottom;—that the boat's company were all deeply affected by a circumstance that was sufficient to render their irri-

* The Lady Hobart was wrecked in June 1803, lat. 46, 33, long. 44°, being then 350 leagues from Newfoundland, by striking against an island of ice. Nineteen persons took to the cutter, and eleven to the jolly boat: in seven days they reached Island cove, Conception bay.—See Domestic Encyclopædia, article Thermometer.

table state more painful;—that he himself was seized with such melancholy, as to lose all recollection of his situation for many hours;—that it was accompanied with violent shiverings, which returned at intervals; and with a refusal of all sustenance, that made his state very alarming. Towards night he enjoyed, for the first time during six days, three or four hours' sound sleep; and perspiration coming on, he awoke as from a dream, free from delirium, though alive to the horrors of their situation. Sleeping, however, in the sun, or being exposed to nightly dews, should be avoided as much as circumstances will permit. It should also be remarked, that a change of climate or of seasons may render this recommendation advisable under given restrictions, as doctor Solander and others have cautioned seamen against sleep, when exposed to extremely cold situations; as, under those cases, it generally ends with sleeping to rise no more.

The effects of *hunger and thirst* are greatly overcome, when the *apprehensions* about them are banished: and we find that captains Inglefield, Bligh, and Woodard, always discouraged despondency; and by giving other pursuits to the human mind, men were frequently diverted from gloomy objects; and when thus roused, they have often been strong enough to surmount the greatest difficulties. We often see men with courage braving danger in battles and enterprises, and risking life to save a life or a wreck; but when self-wrecked, until roused, they are often apt to shrink into despondency, from the want of labour and self-exertion.

It frequently happens, that, after the first panic and exertions in cases of shipwrecks are over, there is then but little expenditure of strength; that smooth sailing saves labour; and, from the want of great bodily exertions, the calls for subsistence considerably lessen. By habit, the body may also be brought to do with less and less sleep; and the same also may be found of food, both as to *quantum* and *quality*; and in this little collection, and in numberless voyages, there are the strongest proofs of how small a quantity of either will sustain the lamp of life for a long period.

Thirst appears to be of a more distressing nature than hunger; but various instances are produced to show how much it has, and may be allayed, only by the preservation of moisture in the mouth, when there has been no other means of satisfying the pressing calls of nature; as a tea-spoonful of water, wine, or spirits, in the cases of an Inglefield, Bligh, and others—or even drops of perspiration from the human body, as in the case of Mr. Holwell while in the Black Hole of Calcutta—have for a length of time satisfied those calls, so as to secure the preservation of life. The moistening of the mouth alone, or the rinsing of it with any liquid, or even with salt water without swallowing any of it, have in many cases been found to produce the most salutary effects; and it may have fallen frequently within the observation of many men, when exhausted or heated in very warm weather, to have complained greatly of thirst, but who have not been able to quench it by great draughts of liquid. The sensations of it have continued until the body itself has been restored to its natural tone, or until moisture has been produced in the mouth to allay it.

Innumerable instances might be produced of shipwrecks and accidents that confirm these facts; and also cases of ships being lost, or locked up in ice in the North Seas and Hudson's Bay, where men of different nations have been hutted for months under ground, to guard against the inclemency of frost and snow, who have survived every hardship from want of food, fuel, and water; and also where men and animals have been buried in snow, or fallen into pits, mines, caverns, and other places, who have been miraculously preserved for a length of time without sustenance, or, if any, on the slightest pittance possible, and that frequently more from a little moisture than from food.*

Seamen have also great encouragement given to them from other considerations:—when they see that others, by having braved the greatest hardships and severities, frequently find a

* The same may be said of light. When men fall into pits and caverns, their eyes, as well as their habits, soon adapt themselves to the greatest changes and powers of contraction, and to their situations.

strength added to those claims which merit, bravery, and other services, have entitled them to from their country; and that many have lived to enjoy promotions and situations in life honourable and respectable, which they never would have enjoyed had they abandoned themselves to despondency and despair. In private life we have seen a Woodard fortunate enough to command the very ship in which he had been a mate before his misfortunes;—a Wilson, after the loss of his ship, and friendly reception at the Pelew Islands, returning home and commanding the Warley, one of the largest class of ships in the India Company's service;—and a Fellowes meriting every attention from the port-masters-general:—while in the navy an Inglefield is a living testimony of his own miraculous escape, and enjoying the reward of gallant and meritorious services in the appointment of a commissioner in the navy, at Gibraltar, during the last war, and now filling the same honourable situation as commissioner at Halifax;—a Riou lived to command the Amazon off Copenhagen, where he lost his life; and his country is now raising a public monument to his memory;—and a Boys, from a midshipman, lived to be elevated to the situation of lieutenant-governor of Greenwich Hospital.

In closing these observations, I beg to remark, that they have been submitted rather as general hints or outlines to be improved upon, than presented as a system of conduct applicable to all situations, climates, and seasons. A change of circumstances will occasion great varieties and exertions which the powers and resources of the moment must dictate. My object has been to encourage hope, confidence, and perseverance in trying situations, from the examples and conduct of others, as some of the best means of self-preservation.

Dr. Lind's advice to prevent the want of provisions at sea.

Dr. Lind, in his Treatise to prevent the Want of Provisions at Sea, states, that two pounds of salep, and the same of portable soup,* will afford a wholesome diet to one person for a month;

* Salep is powdered orchis root. Flour of sweet potatoes, or of the common potatoe; or the latter root, sliced and thoroughly baked, would answer as

and recommends every ship to carry a quantity of these articles to sea, as they would be found extremely beneficial when, through fire, shipwreck, or other accidents, the crew were obliged to have recourse to their boat.

He supposes, were a boat furnished with eleven gallons of water, two pounds of salep, and two pounds of portable beef soup, for each man, that it is probable none would die of hunger, or thirst, for at least a month; during which time the daily allowance per man would be more than a quart of water, eleven ounces of strong salep paste, and an ounce of portable soup.

The soup should be allowed to melt in the mouth; and in that small quantity, if properly made, would be contained the nourishing juices of above three-quarters of a pound of beef. In cases of great extremity the salep might be mixed with salt water, and be still equally wholesome. The salep sells for about four shillings and six-pence per pound, and the portable soup at two shillings and six-pence per pound.

As a careful precaution, he recommends ships to have constantly a cask of water in the boat, or upon deck; and the same precaution respecting the salep and soup being at hand in case of fire, or other accidents at sea, when it might not be possible to go down into the hold for water or provisions.—*Dr. Lind on Hot Climates.*

well, and be much cheaper, and more easily procured than salep. Portable soup is made by slowly boiling down the gelatinous parts of beef, mutton, veal, and pork, with aromatic vegetables, and pouring the mass into chocolate moulds: it will then become solid, and may be dissolved in water as wanted.

Editor.

ON THE PRESERVATION OF SHIPS

BY THE USE OF COMMON SALT.

THE practice of salting sea vessels with a view to their preservation, has long been followed in the port of Philadelphia, and found highly beneficial. The following is the mode adopted:

Pieces of boards are dove-tailed between the timbers and to the outside planks about the floor timber heads: also a little above the listings in the hold, and lastly above the listings between decks. After the vessel has been watered in order to discover leaks, the water drained off, and the timbers are prepared for ceiling, let all the spaces between the timbers and the outside and inside planks be filled with salt, and drove down. The upper rooms must of course be filled before the plank shares are put on. The spaces between the transoms must also be filled.

Salt is only used in vessels built of unseasoned timber, and two of the most experienced ship builders in Philadelphia, gave it as their opinion to the Editor, that a ship built of timber fresh cut and salted as above directed, would far outlast a ship built of the most seasoned timber. The names of several ships built in Philadelphia in 1790, 1792, and since, of unseasoned timber, and salted, were mentioned as being sound to this day.

The effect of the salt is thoroughly to penetrate the planks and timbers, as was evident from a thick incrustation of the salt on the lining of the cabbin of a ship thus salted. This lining was five inches thick and painted. The impregnation of the timbers and planks, will of course cause considerable waste of the salt, and will require a renewal of it after every voyage. One ship, (the Coromandel), built in 1806, of 349 tons, required 575 bushels of salt on the stocks; 300 bushels on her return from Calcutta in about 18 months after she was built; and 250 bushels since. The ship Benjamin Franklin, built in 1795, and of about 263 tons, required 350 bushels. The ship Ploughboy, of 287 tons, built in 1800, took 316 bushels. Vessels even of the same tonnage will require more or less salt, as the spaces between the timbers are greater or less.

PAPERS ON MANUFACTURES.

ON THE MANUFACTURE OF ALUM.

ALUM, improperly denominated Sulphat of Alumine, in the modern nomenclature, is by far the most important of all those with earthy bases.

There are several varieties of salts, composed wholly, or for the most part of sulphuric acid and alumine, clearly distinguishable from each other, though generally confounded together under the vague name of alum.

1. The first is sulphat of alumine, being a saturated combination of alumine and sulphuric acid.

2. The second is acid sulphat of alumine, and differs from the preceding only in containing an excess of acid.

3. The third is acid sulphat of alumine with potash, crystallizing in octohedrons.

4. The fourth is acidulous sulphat of alumine with potash, crystallizing in cubes.

5. The fifth is sulphat of alumine with potash, or alum neutralized by its own earth, pulverulent, insipid, insoluble in water.

6. The sixth is acid sulphat of alumine with ammonia.

7. The seventh is acid sulphat of alumine with potash and ammonia, or the *common alum of the shops.*

The simplest process by which alum is prepared, is that in use at the Solfatara, near Naples. The Solfatara is a small plain on the top of a hill, covered with a white soil, in which are numerous round holes or craters, from which sulphureous vapours constantly ascend, and impregnating the soil, form a rich ore of alum, from which the alum of the shops is prepared by boiling and crystallization.

The alum works of La Tolfa, near Civita Vecchia, in the Roman State, are among the oldest in Europe, and the alum made there is the finest of any. The ore made use of, is the *Alaustein* of the Germans, or alum stone, of a grayish or yellowish white, or light-yellowish or smoak-gray; and found in considerable masses, and so hard as to require blasting by gunpowder.

Alum is also made from pyrito-aluminous ores.

The only manufacture of alum conducted upon strict chemical principles, is that established by Chaptal some years ago, near Paris; by the direct union of sulphuric acid and pure clay, and producing alum only inferior to that of La Tolfa. These two last processes are fully described in Aikin's Chemical Dictionary. Chaptal's process was originally published in the Annals of Chemistry of Paris, Vol. 3.*

By far the greater part of the European alum is prepared from the aluminous slate or the aluminous earth:† and this process shall now be given.

The process practised in the manufactory of Alum, near Whitby, Yorkshire, by Richard Winter.‡

" The aluminous schistus is generally found disposed in horizontal laminæ. Sometimes it exists in the form and appearance of indurated clay; in fact the whole of the upper part of the stratum resembles indurated clay, when first wrought; but by exposure to the atmosphere it suffers decomposition, and crumbles into thin layers. The upper part of the rock is the most abundant in sulphur, and the deeper they work into it, the quantity of sulphur decreases, and the bituminous substance increases, and the rock becomes more hard and slaty; so that a cubic yard of rock, taken from the top of the stratum, is as valuable as 5 cubic yards taken at the depth of 100 feet.

When a quantity of the schistus is laid in a heap, moistened with sea water, it will take fire spontaneously, and will continue to burn until the whole of the combustible materials are exhausted.

The colour of the aluminous schistus is a bluish gray. Its hardness differs; at the top part of the strata it may be crumbled

* It is also published in the Repertory of Arts. *Editor.*

† The foregoing account of Alum is collected from Aikin's Chemical Dictionary. *Editor.*

‡ From Nicholson's Philosophical Journal, Vol. 25, (April, 1810.)

in pieces between the fingers, at a considerable depth it becomes as hard as roof slate. The specific gravity is about 2.48, it contains silex, alumine, magnesia, lime, oxide of iron, bitumen, sulphur, and water.

Of the Calcination and Lixiviation of the Schistus

The covering strata are removed previous to working the alum rock (as it is generally called). The hewing of the rock is performed with picks and javelins; and it is conveyed to the calcining place in barrows, so contrived, that the centre of gravity of the weight, is in a perpendicular line passing through the centre of the axle of the wheel; by this means the men have nothing more to do, than to keep the barrow steady, throw the weight of the substance upon the wheel, by raising the handles, and direct the barrow upon the way, which is formed of cast iron plates, 6 feet in length, 6 inches in breadth, and half an inch thick; these plates are fastened into cross pieces of wood fixed into the ground, at the end of each plate. Ten of these barrrows contain one solid yard of the rock. The expenses of working the rock vary according to the facility with which it can be hewn. When the distance the rock is to be barrowed is about 200 yards, the rate for removing and hewing one cubic yard is about 6½d. It is unnecessary to state, that the price must maintain a corresponding ratio with the distance to be conveyed. The men earn about 2s. 6d. per day in the winter season, and 3s. in the summer.

The rock is poured out of the barrows upon a bed of fuel, composed of underwood, furze, &c. The dimensions of this pile of faggots is about four or five yards in breadth, and two in height; as the rock is deposited upon the fuel, it is necessary that it should be broken into small fragments, that the combustion may take place with the greater facility. When they have got about four feet in height of the rock upon the faggots, fire is set to the bottom, and fresh rock continually poured upon the pile; other piles of wood are then placed alongside of the first, and they proceed as before, adding more rock, firing the fuel, &c. This they continue, until the calcined heap is raised to the height of 90 or

100 feet, and from 150 to 200 feet in length and breadth. Some of these heaps of calcined mine (as it is now called) will contain 100,000 solid yards of schistus or rock.

When the whole heap is in a state of combustion, a considerable quantity of sulphureous acid gas is disengaged; this they endeavour to prevent, by moistening small schistus, and forming a kind of clay; with this they plaster the outside of the heap; this however does not prevent the escape of the gas in any degree, but it prevents the wind from penetrating, and assists in preventing the calcined mine from falling, by forming a kind of crust all over the heap; this crust is soon decomposed by the action of rain, &c.

The form of the places for calcining the rock in, is badly calculated to prevent the escape of the sulphureous acid gas. If the combustion was effected in a building of the shape of a smelting furnace, immediately upon the whole of the rock becoming ignited the opening might be closed, and the gas preserved. I have ascertained by experiment, that nearly one half of the sulphureous acid gas is expelled by a red heat, continued for a considerable space of time.

The sulphureous acid gas, by absorbing oxigen from the atmosphere, is converted into sulphuric acid; this change is effected by means of the oxide of iron contained in the mine, and moisture. It would certainly be worth ascertaining by experiment, whether the oxide of iron combined with sulphur in burning would not yield sulphuric acid if moistened with water.

I am aware that iron has a greater affinity for oxigen than sulphur has in the fire, but in the great scale of nature she observes laws peculiar to herself: the affinities observed in the salts of the ocean are contrary to the order they appear in our tables; here, we find the small portion of sulphuric acid united to the lime; instead of forming a union with the soda, as might be inferred. Lime is found to decompose the muriate of soda. These, and other anomalies might be produced, but they are foreign to the purpose.

130 tons of calcined mine will produce 1 ton of alum. I have

deduced this number from an average of 150,000 tons of calcined mine consumed.

The calcined mine is steeped in water, contained in pits, that usually hold about 60 cubic yards. The water thus impregnated with sulphate of alumine, called alum liquor, is drawn off into cisterns, and afterward pumped up again upon fresh calcined mine. This is repeated until the liquor becomes concentrated to the specific gravity of 1.15; or 12 pennyweights of the alum maker's weight. The half exhausted mine is then covered with water, successively, to take up the whole of the sulphate of alumine; these liquors, thus impregnated, are denominated strong liquor, seconds, and thirds.

The strong liquor is drawn off into cisterns, to deposit the sulphate of lime, iron, and earth suspended in it. In order to free the liquor from these substances, they clarify it by boiling for a short time, which enables the sulphuric acid to exert its affinities with greater energy. After running it from the pans, and suffering it to cool, the whole of the sulphate of lime, iron, superfluous alumine, and earth, are deposited; and the alum liquor is nearly pure. Where this precaution is used, the alum is much better in quality, and almost entirely divested of the sulphate of iron. This method is only practised at some of the works, owing to the additional quantity of fuel required, and consequently increased expense.

The liquor in this state is carried by means of pipes, or wooden gutters, into leaden pans. These pans are made of sheet lead (cast by the workmen in the alum house) 10 feet long, 4 feet 9 inches wide, 2 feet 2 inches deep at the hinder part, and 2 feet 8 inches at the front end: this difference is allowed to give a rapid current in running off.

A quantity of mothers is pumped into the pans every morning; and, as this evaporates, the deficiency is supplied with fresh alum liquor, every two hours, or, as the liquor in the pans becomes more concentrated, the additions are made more frequently. It is necessary to keep the pans continually boiling, otherwise the superfluous alumine and sulphate of alumine, deprived

of its water of crystallization, would be precipitated, and the pans melted, from the crust formed between the liquid and the lead.

Each pan will produce upon an average 4 cwt. of alum daily, and the consumption of coals will be about 18 bushels Winchester measure.

The liquid contained in the whole of the pans is run off every morning into a vessel called a settler, at the same time a quantity of alkaline lee is brought along with the boiling liquor, prepared either from kelp, soapers lees, (generally called black ashes) or muriate of potash, of a specific gravity from 1·037, to 1·075. The alum maker having previously ascertained the specific gravity of the liquid in his pans, estimates the quantity of alkaline lees to be added, necessary to reduce the liquor from the pans from the specific gravity of sometimes 1·45 or 1·5 to 1·35.

The liquor then stands in the settler about two hours, that it may deposit the sediment it may contain, when it is run off into the vessel (or coolers) to crystallize.

If the alum maker should be below, or equal to the specific gravity of 1·35, in mixing the alkaline lee and liquor, there is nothing more to be done. If he exceed this specific gravity, he then adds urine in the coolers, until the liquid is reduced to 1·35. It is then agitated to combine the heavy and light liquids, and then left to crystallize. It must be observed, that at a greater specific gravity than about 1·35, the liquor, instead of crystallizing, would present us with a solid magma resembling grease.

After standing four days, the mothers are drained off, to be pumped into the pans again the succeeding day. The crystals of alum are conveyed into a tub, where they are washed in water, and put into a bin, with holes in the bottom, to allow of the water draining off from the alum. They are then removed into a pan (twice as large as the common leaden pans), and as much water added as is found requisite to dissolve the whole of the alum when in a boiling state; the moment this is effected, the saturated boiling solution is run off into casks. These casks should stand about 16 days; as they require this time to become perfectly cool, in the summer season. The casks are then taken

to pieces, and a hollow cask of alum is produced; it is then broke into, and the whole of the saturated solution of alum (called tun water) is removed back into the pans, to go through the process anew.

This last process is called roching. The outside of the cask of alum is now to be cleared from dirt, and the sediment which is deposited at the bottom. It is then broken up into masses ready for the market.

Practical observations and remarks upon the foregoing processes.

The method pursued by the alum makers to find the specific gravity of any liquid is capable of considerable accuracy. A bottle is procured, that will contain about $\frac{1}{3}$ of a pint. The narrower the neck, the more accurate will be the results obtained by it. This bottle is balanced in a pair of sensible scales, we will suppose it to weigh 1000 grains, it is then filled with distilled water, and carefully dried with a cloth; now allowing the water to weigh 2400 grains, this last number is divided into 80 parts or pennyweights, and we have 30 grains corresponding to one pennyweight; this they subdivide into $\frac{1}{2}$ and $\frac{1}{4}$. Hence we may ascertain the relative specific gravity of any liquid. 1 pennyweight is equivalent to 1·0125, and 80 pennyweights to 2·0. Care however is necessary, to have a counterweight of 3400 grains, equal in weight to the water and bottle together, which must always be put into the scale, along with the other weights, in operating. This was formerly a great secret among the alum makers, and they sold the method at a high price, or handed it down to their children as an hereditary possession.

Considerable advantage might be derived to the manufacturer, by reducing the size of the fire places, and erecting iron doors, to prevent a current of air passing over the fire, instead of entering by the ash pit: a very material saving of fuel would arise from adopting this method.

A very material error is committed, by concentrating the liquor in the pans to near the specific gravity of 1·5, and then re-

ducing it again to 1·35: this method obliges them to evaporate a very unnecessary quantity of water.

The alum liquor is frequently brought into the pans as low as 1·09; when by repeatedly bringing the liquor over fresh calcined mine, it might be concentrated to 1·25, or more. I will mention an instance where the expenditure in evaporating liquor was more than £3 10*s*. daily; when at the same time this liquor might have been concentrated to an equal degree, by repeatedly pumping the liquor upon fresh calcined mine, at an expense of not more than 9*s*. in the same time; here there was a loss of £3 1*s*. daily.

In using black ashes, or kelp, a considerable quantity of charcoal is dissolved in the alkaline lee; this charcoal is precipitated on adding a small quantity of the solution of sulphate of alumine, but is redissolved again by adding the solution in excess.

This charcoal then contaminates the alum, and decomposes a quantity of the sulphuric acid: therefore, it must appear conclusive, that whatever alum is made with muriate of potash alone will be far superior in quality, while the produce will be greater in quantity.

It might be supposed, that urine was a necessary ingredient in the making of alum; but the fact is, it merely hides the ignorance of an alum maker. Having no determinate rule to guide him, in reducing the liquor from the pans, should he chance to exceed the specific gravity of 1·35, he adds urine, or some such light fluid, to bring the liquor as near as possible to this density. The alum works, that approach the nearest to the true chemical principles, are those of the Right Hon. Lord Dundas, and Messrs. Baker and Co. They use no urine in these works—the alum liquor is always clarified previous to its being used—they use no alkali generally, but crystallized muriate of potash—greater economy is observed in the consumption of fuel; and the result is a product of alum considerably larger in a given time, and of better quality, than can be produced by the works established upon the old plan.

The kelp used is obtained by burning the sea wrack in kilns,

at a great number of places upon the coast of England, Scotland, &c. It is a very inferior alkali in an alum manufactory. It contains about 47 of soluble salts, and 53 of charcoal, sand, and earth. The salts are muriate of soda, soda, and sulphate of soda.

The refuse of the soap boilers' lees are burnt in a kind of oven, and sold under the name of black ashes. The composition of these ashes is about 90 of soluble salts, and 10 of charcoal and earth, the salts contain muriates of soda and potash, sulphate of potash, and muriates of lime and magnesia.

I have always found great difficulty in producing alum by the muriate of soda, and never could form alum in any way by means of pure soda.

The muriate and sulphate of potash are the only alkalis that can be used to advantage in the composition of alum.

I have made comparative experiments to ascertain the quantity of the different alkalis it would require to produce 100 tons of alum. The following are the results:

22 tons of muriate of potash will produce 100 tons of alum,
31 ditto of black ashes .... 100 ditto,
73 ditto of kelp .... 100 ditto.

The alkalis are considered as in the state in which they are found in commerce.

ON A NEW BLACK DYE TO BE APPLIED TO ALL KINDS OF LINENS AND STUFFS.

By Mr. HERMBSTAEDT, *Berlin.**

THE black colours which are generally applied to linen and cotton stuffs are composed of iron and vinegar. Their base is always oxide of iron, which is mixed with decoctions of wood of different kinds. All these colours incline either to red or blue, and they resist but feebly the action of the air, of water, and of acids. The tincture which I have composed, and which I use

* From Biblioth. Phys. Economique, an xiv. No. 2.

daily in dyeing all kinds of cotton, silk, or wool stuffs to an unalterable black, embraces an intimate union of the oxide of iron with that of copper and the pyro-ligneous acid.

Preparation of the Pyro-ligneous Acid

Take a tubulated retort made of plate iron, or of cast iron which is better, place it in a furnace in such a manner that the neck be perfectly free, and the bottom receive directly the heat of the fire. It must be luted carefully, and there must be introduced into the retort some chesnut wood cut into small bits. The distillation then commences with a very moderate fire, which is progressively increased till no more liquid passes into the receiver. The acid which is found in the receiver, mixed with a kind of oil, may be separated from it by a filter of gray paper: the wood will be reduced to charcoal in the retort.*

Preparation of the Oxide of Iron.

Dissolve 4 pounds of vitriol (sulphate) of iron, very pure, in 24 pounds of rain water. Dissolve in like manner 4 pounds of potash in 12 pounds of filtered water. These two solutions, when well mixed, will appear at the beginning of a deep green; but in a little time the surface exposed to the air will take a dark red colour; then pour the whole on a filter of linen: the oxide which will remain after the water has passed ought to be washed in a great deal of water, to free it from all adhering salt. Leave this oxide exposed on a plate to the action of the atmosphere, which will reduce it to a state of red oxide.

Preparation of the Oxide of Copper.

To prepare this oxide, take a pound of blue vitriol of Cyprus (sulphate of copper), which dissolve in 12 pounds of rain water: make it boil, and mix with it a pound of water saturated with potash, and you will obtain a green precipitate, which must be well washed after being filtered.

* Compare Archives, Vol. 1, p. 406. *Editor.*

Preparation of the Mordant for Black.

Take three parts of the oxide of iron and one part of the oxide of copper: triturate them in a marble mortar, and pour on them the necessary quantity of pyro-ligneous acid to dissolve them. Filter the whole to separate the thick parts, and the mordant is made.

Application of this Mordant in dyeing Black.

Steep the stuffs intended to be dyed in this mordant thickened at pleasure. Afterwards proceed to the dyeing in the ordinary decoctions made with different dye-woods. The colour obtained will be a very beautiful black, and almost unchangeable by all chemical agents. If the black is meant to serve for printing stuffs or cloths, it is thickened very much, and by mixing it with different tinctures of dye-wood, it will form a black equally beautiful and lasting.

PROCESS EMPLOYED TO OBTAIN A LIQUID BLACK,

Invented by Mr. Clarke, an Englishman, and introduced into commerce; its use in marking linen in a solid and durable manner, and its application for printing cottons or stuffs.

By Mr. HERMSTAEDT, *of Berlin.*

FOR these two or three years past, a black tincture has been sold for the purpose of marking linen.

A glass polisher and directions for using the tincture accompany the two bottles which contain the ingredients, and the whole is sealed up in a case.

One of the bottles contains the mordant. The other contains the ink, which is of a deep brown colour, and which must be well shaken before making use of it, because it subsides when left to rest.

The part of the linen intended to be marked, must be in the first place impregnated with the mordant, which is allowed to dry

on the linen. Thc place which had been wetted is then rubbed with the polisher; an ordinary pen is then dipped in the ink, and the writing is performed on the linen the same as on paper. Neither soap nor any chemical preparation will destroy this writing, which, when well dried, is of a very fine black.

Having chemically analysed these two liquids, I am able to give an accaunt of the ingredients which compose them.

Preparation of the Ink.

Dissolve in nitric acid (aquafortis) what quantity of silver you please. This solution, if the silver has been alloyed with copper, will be of a sapphire blue.

In order to separate the copper from the silver add to the solution twelve times its weight of distilled water, or, for want of it, rain water, and suspend in it a thin plate of copper. In proportion as this plate dissolves, the silver will precipitate itself, perfectly pure, in the form of a white powder. When no more of this powder will precipitate itself the liquor should be decanted. The powder is then washed in a great quantity of water, until the water thrown upon it is no longer of a blue cast, but remains perfectly limped. The residue, *i. e.* this powder, well dried, will be silver in its purest state.

If this residue weighs one ounce, dissolve as much gum senegal and two drachms of white glue in two ounces of distilled water. Mix this solution wich three drachms of lamp-black well calcined in a close crucible.

To manufacture this mixture properly, it ought to be triturated in a glass mortar.

This operation being finished, the solution of silver, diluted in eight times its weight of distilled water, is poured upon the above mixture; the whole is then well stirred with a spatula, and the ink is made.

Preparation of the Mordant.

Dissolve two ounces of white glue and as much isinglass in six ounces of alcohol, and as much distilled water. This solution

will be made in two days. The B. M. is made use of for the purpose; and care must be taken to stir the two kinds of glue from time to time.

After the whole is dissolved, it must be filtered through flannel, in order to keep back all its mucilaginous particles. The liquid thus filtered, and preserved in a bottle well corked, is then ready for use.

Manner in which the Ink acts.

The solution of silver in the nitric acid is nothing else than the composition of the *lapis infernalis;* and every one knows its properties in staining the skin, nails, &c., of a black colour. If the linen or stuff is first impregnated with the above mordant, which is an animal substance, the ink may be afterwards applied without spreading, and will completely dye every thread of the part to which it is applied, the mordant having previously partly animalized the fibre of the fabric.

Soap, or any other ingredient used in washing, may obliterate the lamp black, but it never takes out the nitrate of silver; and the object proposed is therefore perfectly well attained.

Application of the Ink for printing orange Cotton and other stuffs.

We may easily conceive that this ink may be employed with advantage for printing cloths of a white, yellow, or rose ground, or any other clear colour.

The cloths or stuffs intended to be printed in this manner require no other preparation than to be dipped in a solution of parchment or isinglass; and after they are dried they must be rubbed with a glass polisher.

The ink must be thickened for this purpose with a greater quantity of gum senegal, and then applied upon the cloths or stuffs in the usual manner by means of wooden or metal stamps.

Three or four days after this operation the stuffs must be first washed with a great quantity of clear water, and afterwards with soap and water, which will make them appear of a finer black.

THE PROCESS FOR DYEING NANKEEN COLOUR.

*By Richard Brewer.**

MIX as much sheep's dung in clear water as will make it appear of the colour of grass, and dissolve in clear water one pound of best white soap for every ten pounds of cotton-yarn, or in that proportion for a greater or lesser quantity.

Observe: The tubs, boards, and poles, that are used in the following operations, must be made of deal; the boiling pan of either iron or copper.

First operation.—Pour the soap liquor, prepared as above, into the boiling pan; strain the dung liquor through a sieve; add as much thereof to the soap liquor in the pan as will be sufficient to boil the yarn, intended to be dyed, for five hours. When the liquors are well mixed in the pan, enter the yarn, light the fire under the pan, and bring the liquor to boil in about two hours, observing to increase the heat regularly during that period. Continue it boiling for three hours, then take the yarn out of the pan, wash it, wring it, and hang it in a shed on poles to dry. When dry, take it into a stove or other room where there is a fire; let it hang there until it be thoroughly dry.

N. B. The cotton yarn, when in the shed, should not be exposed either to the rain or sun; if it is, it will be unequally coloured when dyed.

Second operation.—In this operation use only one half of the soap that was used in the last, and as much dung liquor (strained as before directed) as will be sufficient to cover the cotton yarn, when in the pan, about two inches. When these liquors are well mixed in the pan, enter the yarn, light the fire, and bring the liquor to boil in about one hour; then take the yarn out, wring it without washing, and hang it to dry as in the former operation.

* From Transactions of the Dublin Society, Vol. 1, part 1.

Third operation.—This operation the same as the second in every respect.

Fourth operation.—For every ten pounds of yarn make a clear ley from half a pound of pot or pearl ashes. Pour the ley into the boiling pan, and add as much clear water as will be sufficient to boil the yarn for two hours; then enter the yarn, light the fire, and bring it to boil in about an hour. Continue it boiling about an hour, then take the yarn out, wash it very well in clear water, wring it, and hang it to dry as in former operations.

N. B. This operation is to cleanse the yarn from any oleaginous matter, that may remain in it after boiling in the soap and dung liquors.

Fifth operation.—To every gallon of iron liquor* add half a pound of ruddle, or red chalk, (the last the best) well pulverised. Mix them well together, and let the liquor stand four hours, in order that the heavy particles may subside; then pour the clear liquor into the boiling pan, and bring it to such a degree of heat as a person can well bear his hand in it; divide the yarn into small parcels, about five hanks in each; soak each parcel or handful very well in the above liquor, wring it and lay it down on a clean deal board. When all the yarn is handed through the liquor, the last handful must be taken up and soaked in the liquor a second time, and every other handful in succession, till the whole is gone through; then lay the yarn down in a tub, wherein there must be put a sufficient quantity of ley made from pot or pearl ashes, as will cover it about six inches. Let it lie in this state about two hours, then hand it over in the ley, wring it, and lay it down on a clean board. If it does not appear sufficiently deep in colour, this operation must be repeated till it has acquired a sufficient degree of darkness of colour; this done, it must be hung to dry as in former operations.

N. B. Any degree of red or yellow hue may be given to the

* Iron liquor is what the linen printers use.

yarn by increasing or diminishing the quantity of ruddle or red chalk.

Sixth operation.—For every ten pounds of yarn make a ley from half a pound of pot or pearl ashes; pour the clear ley into the boiling pan; add a sufficient quantity of water thereto, that will cover the yarn about four inches; light the fire, and enter the yarn, when the liquor is a little warm; observe to keep it constantly under the liquor for two hours; increase the heat regularly till it come to a scald; then take the yarn out, wash it, and hang it to dry as in former operations.

Seventh operation.—Make a sour liquor of oil of vitriol and water; the degree of acidity may be a little less than the juice of lemons; lay the yarn in it for about an hour, then take it out, wash it very well and wring it; give it a second washing and wringing, and lay it on a board.

N. B. This operation is to dissolve the metallic particles, and remove the ferruginous matter, that remains on the surface of the thread after the fifth operation.

Eighth operation.—For every ten pounds of yarn dissolve one pound of best white soap in clear water, and add as much water to this liquor in your boiling pan, as will be sufficient to boil the yarn for two hours. When these liquors are well mixed, light the fire, enter the yarn, and bring the liquor to boil in about an hour. Continue it boiling slowly an hour; take it out, wash it in clear water very well, and hang it to dry as in former operations: when dry, it is ready for the weaver.

N. B. It appears to me, from experiments that I have made, that less than four operations in the preparation of the yarn will not be sufficient to cleanse the pores of the fibres of the cotton, and render the colour permanent.

THE METHOD OF GILDING ON GLASS.*

By Richard Hand.

TAKE a piece of parchment, about twice the size of a crown piece; put it in a pint of water; in the evening and in the morning, beat it for about half an hour, and it will be fit for use.

Take a small brush, and give the glass, which is to be gilt, a thin coat. Get your gold ready to lay on, breathe on the size which is on the glass, and lay on the gold. When all is covered with gold, rub it with cotton, when dry; then give the gold another coat of that size, and do as above, by breathing on the gold and putting on another coat. When the whole is covered with gold, rub it with the cotton, then give it another coat of size, and on that lay on leaf silver, until all is covered. Rub the silver with cotton; then have ready some water about blood warm, put the glass which is gilt in it, and let it stand about a quarter of an hour; take it out and let it dry, and when dry, proceed to varnish it.

SPIRIT VARNISH.†

By Richard Hand.

THERE are various kinds of spirit varnish, all of which I have made and used; but as the hardest varnish of the spirit kind is the best for gilding on glass, the following, in my opinion, is by far the most preferable.

Take of rectified spirits of wine one quart, gum animi two ounces, seed-lac three ounces, gum mastic one ounce; keep it in a warm place, and the gums will dissolve in the spirits, which must be strained through a flannel cloth and then kept for use.

This varnish, as well as all others formed of spirits, must be laid on the work, to be varnished, warm; for either cold or

* From the Transactions of the Dublin Society, Vol. 1, part 1. † Ibid.

moisture chills all spirit varnish, and prevents its taking proper hold of the substance, on which it is laid.

N. B. A very fine painted glass window of Mr. Hand's performance, is put up in the Museum of the Society.

PROCESS TO DISCOVER ADULTERATED POTASH.

*By Wm. Higgins, M. D. professor of Chemistry and Mineralogy to the Dublin Society.**

AS pot-ash is the principal agent in the bleaching of linen, no foreign article imported into this country deserves more attention.

Pearl or pot-ash contains from 10 to 12 per cent. of impurities, mostly sulphat of pot-ash, and sometimes a small portion of muriate† of pot-ash. These salts must have been yielded by the wood, and dissolved by the large quantity of water necessary to separate the pot-ash from the ashes.

I more than once obtained near 20 per cent. of sulphat of pot-ash from the pearl-ash imported here; this great portion of sulphat of pot-ash could have never been a natural product, but must have been an artificial adulteration; and indeed, circumstances have convinced me that it must be so.

During a mineralogical excursion through England in the summer and autumn of the year 1785, the different manufactures, which fell in my way, were not passed over. Upon enquiring of the distillers of aquafortis (nitrous acid) how they disposed of the large residum left in the still (when the acid was carried over) which is sulphat of pot-ash, and which is of little or no use in the arts, they informed me it was bought up by the Irish merchants.

Sulphat of pot-ash, when ground down, cannot readily be distinguished as to its external appearance from pearl-ash, and be-

* From Transactions of the Dublin Society, Vol. 1, part 1.

† Muriate of pot-ash, a neutral salt, consisting of marine acid and pure pot-ash.

ing so much cheaper than the latter, is well calculated for the above fraudulent purpose.

By no means do I intimate that this is a common practice, as from experience I know the contrary.

However to pass it over in silence would be unpardonable, when it is considered that the bleacher is at the expense of an article of no use whatever in bleaching, and that, by the adulteration, the proportion best known by experience to answer his purpose is varied; by which means his process, although not altogether frustrated, must be materially retarded.

Sulphat of pot-ash is only soluble in about sixteen times its weight of water, in the temperatue of 60°, while real pot-ash is soluble in its own weight of water, in the same temperature; hence they are easily separated in the following simple manner, viz. three pounds of pearl-ash and two quarts of water should boil together for a few minutes, then be removed from the fire and suffered to stand for twenty-four hours, when the clear liquor is to be decanted off. Half a pint more of cold water is to be poured upon the dregs, and this again drawn off when clear: the insoluble salt is afterwards to be well dried and weighed, which being a foreign salt, will give pretty nearly the quantity of impurities in the pot-ash.

The purest pot-ash imported, always contains, as I have before observed, a certain quantity of sulphat of pot-ash (vitriolated tartar); and this quantity is no doubt the natural production of the vegitable itself which affords the pot-ash. Some muriate of pot-ash (regenerated sea salt) has occasionally been found in it; but in portions too inconsiderable to injure any art or manufacture, in which pot-ash is used.

Within the last year however I have discovered, to my great surprise, in several specimens of pot-ash, which I have examined for the bleachers, a large quantity of muriate of soda (common sea salt). The last specimen of this sort was examined by my pupils, under my own immediate inspection, in the Laboratory of the Dublin Society, and it afforded upwards of one-fifth of foreign salt; the proportion being as follows.

		Grs.
Aerated (mild) pot-ash	- - - -	1690
Muriate of soda	- - - - -	270
Sulphat of pot-ash	- - - - -	200
Total,	- - - - -	2160

This last analysis was made for a Mr. Harrison, an eminent glass manufacturer at Belfast, who had suffered very materially in his manufacture, by the adulteration of his pot-ash; and I have no doubt, that rock salt, which is the same as common salt, but much cheaper than that which is prepared for commerce, was mixed in powder with the pot-ash previous to its importation. Muriate of soda, being besides much more soluble in water than sulphat of pot-ash, is less easily detected, and separated from the pot-ash.

The following is the method, which I adopted for determining the nature and proportion of the ingredients.

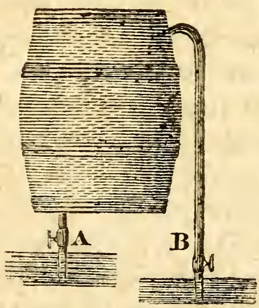
The specimen having been first weighed, was digested for a few minutes on a sand bath, twice its weight of water, in a heat of about 212, and instantly stirred. It was then removed from the sand bath, and before cooled to the temperature of the atmosphere, filtered through paper. As soon as all the liquor had passed through the filter, a small quantity of cold water was poured, from time to time, upon the saline residuum upon the filter, in order to wash through the whole of the pot-ash. The undissolved salt, which was sulphat of pot-ash, was afterwards dried and weighed. In the clear solution, however, there remained, not merely the pot-ash, but such salts as possessed sufficient solubility to be taken up along with it by the water, though in fact not so soluble as the pot-ash itself. To get at these the following means were used; the clear solution was evaporated down a little on the sand bath, and set by in a cold place for 24 hours: at the end of which time, a quantity of common salt was found crystalized in regular cubes at the bottom of the vessel. From these the liquor was perfectly drained, and being preserved, the same

process was repeated, till there ceased to be any deposition of cubic crystals.

Before the muriate of soda, thus procured, was weighed, some muriatic acid was poured on it, in order to take up any of the pure pot-ash, which might have adhered to it during its crystalization. The muriatic acid, with such of the pot-ash as it had found and dissolved, was then drained off and thrown away, and the muriate of soda dried and weighed. The sum of the impurities being then substracted from the weight of the specimen, the quantity of the pot-ash was ascertained.

This new species of adulteration must be a great drawback on our staple manufacture, and deserves therefore very serious consideration.

The Syphon applied to the Worm Tub as a Refrigerator; or, A Plan for conveying Water in any Quantity to a Worm Tub of the largest Dimensions, if perfectly air tight. By ALEXANDER JOHNSTON, Engineer.*



A. The feed pipe of cold water.

B. The hot water, or waste pipe, the end of which must be about two feet lower than the feed pipe, to make it act with full effect.

When you commence work, you must shut the cocks, and fill the tub through a hole at top, (and of course both pipes) and, when full, stop the hole at top, and open the cocks together; the

* From *Transactions of the Dublin Society*, vol. iii.

water will then commence running, and continue as long as the supply holds good, as it acts in every respect on the principle of a syphon.

By this means pumps, horse mills, and other machinery, are rendered unnecessary for that purpose.

The application of this improvement is simple, and executed at a very little expense. The saving, I think, may be calculated at upwards of one hundred horses per annum, for the city of Dublin alone.

I have executed one for Nicholas Roe, esq. Marybone-lane.

Dublin, July 6, 1803. ALEXANDER JOHNSTON.

ON THE CONVERSION OF IRON INTO STEEL BY CEMENTATION—ON CASE HARDENING—ON CAST STEEL.*

THE usual method of converting iron into steel is by *cementation*.† For the purposes of manufacture, this is performed in large quantities at a time in the following manner. A cementation or converting furnace consists of two parallel troughs, constructed of fire-brick, sufficiently long to admit with convenience a common bar of iron; these troughs rest upon a long grate from which flues proceed, so as to distribute the heat as evenly as possible to every part: an arched vault is thrown over the top, and the whole is inclosed within a cone of masonry as the glass house furnaces are. The bars of iron intended for cementation are of the very best quality, (in England none but the Swedish Oregrund iron is employed for this purpose) and are carefully examined to ascertain that they are quite free from cracks, flaws, and every appearance indicative of their not being completely malleable. The requisite selection being made, a stratum of coarsely bruised charcoal is laid at the bottom of the cementing trough, upon which is arranged a layer of iron bars: to this

* From Aikin's Chemical Dictionary.

† Collier in Manch. Trans. V. p. 122. [Mr. Collier gives a plate of the cementing furnace. *Editor.*]

succeeds another of charcoal, and so on till the trough is nearly filled, observing that the upper as well as the lowest layer is charcoal: it is then covered with a mixture of hard rammed clay and sand in order to exclude the air. A trough thus charged will contain from seven to ten tons of iron. The fire being lighted, the heat passes into the flues and raises the temperature of the troughs to a glowing red, which is maintained for the space of from seven to eleven days, according to the quantity of iron. At the extremity of each trough is a small hole, through which two or three bars project a few inches in order that they may be occasionally withdrawn to ascertain the progress of cementation: when by the trial bars, it appears to be complete, the fire is put out, and after the troughs are sufficiently cool they are emptied of their contents. The form of the bars thus converted, remains unaltered, but their surface is covered over with bubbles or blisters, whence the steel in this state is called *blister steel:* it is heavier than the iron from which it was made, on account of its having absorbed a portion of carbon from the charcoal with which it was in contact, though this is by no means the only action that takes place in the process of steel-making, as we shall show in the next section. Blister steel is employed only for the coarsest purposes, such as pointing horses' shoes, ploughs, and other agricultural instruments, &c. By being drawn down into smaller bars under the tilt-hammer, its texture is considerably improved, and it is known in the markets by the name of *tilted steel.* As repeated hammering improves iron, so it does steel: hence if a bar of highly carbonized blister steel is broken into very short pieces, and these being formed into small packets, are again welded together and drawn down into bars, which being again doubled together are welded and tilted, repeating the process two or three times, the result will be a very material improvement in compactness and toughness, and the metal will be found well qualified for swords and the larger articles of cutlery: this steel has long been prepared in high perfection in Germany, whence it is called *German steel;* it is also known by the name of *shear-steel.*

This is the proper place to mention the process of *case-hardening*, which in fact is only an imperfect kind of cementation, converting little else than the immediate surface of the metal into steel, and therefore being performed not on the rough bar but the manufactured article. The cements or carbonaceous substances used on this occasion are bone shavings or turnings, horn cuttings, and old leather shoes. The work intended to be cased having been previously filed to the requisite shape, that there may be as little occasion as possible to apply the file afterwards, is laid together with the cement in a pan of plate-iron. A forge fire is then made of considerable size, and when the upper part has caked together it is carefully lifted off without breaking, the pan is laid upon the red coals and covered with the caked mass. In this state it remains for nearly two hours, without urging the fire. Small pieces of iron wire that have been previously introduced into the pan being withdrawn from time to time, are dipped while hot in cold water, and by the file and the character of the fracture, the progress of the cementation is determined. When the intended degree of carburation is obtained, the fire is increased, and the articles as soon as sufficiently heated are taken out of the pan and plunged in cold water. The inferior kinds of table-knives and some surgical instruments, where a considerable degree both of toughness and hardness is required, are prepared in this way.*

The finest kind of steel, however, called *English cast steel*, yet remains to be mentioned. It is commonly prepared by breaking to pieces the blister steel, and then melting it in a crucible with a flux composed of carbonaceous and vitrefiable ingredients. When thoroughly fused it is cast into ingots, which by gentle heating and careful hammering, are tilted into bars. By this process the steel becomes more highly carbonized in proportion to the quantity of flux, and in consequence is more brittle and fusible than before; it is inferior to the other kinds of steel in being incapa-

* For the above, and some other practical information contained in this article, the authors are indebted to the professional liberality of Mr. W. H. Pepys.

ble of welding either with iron or steel, but on the other hand, surpasses them all in uniformity of texture, hardness, and closeness of grain, hence it is the material of all the finest articles of English cutlery. The composition of the flux used in preparing this steel is kept a secret among a few manufacturers, and in consequence various experiments have been instituted both here and elsewhere, to discover either the same or an equally successful method of making this beautiful substance. In 1795, Clouet published the results of some valuable experiments, from which it appears, that by simply fusing bar iron with charcoal, a cast steel may be obtained more or less carburetted, according to the proportion of charcoal employed, and therefore possessing at pleasure in a greater or less degree, the qualities of fusibility, brittleness, and hardness: he also showed that the same effects may be produced by fusing bar iron with glass and charcoal, or the black oxyd of iron, with the requisite proportion of charcoal alone, or by keeping in fusion for about the space of an hour a mixture of small bits of iron and equal parts of clay and marble or any other calcareous carbonat.* In 1800, Mr. Mushet took out a patent for preparing cast steel of various qualities, by fusing bar iron with different proportions of charcoal, coinciding for the most part with the facts and principles before laid down by Clouet, and confirmed by his own experiments;† but whether the steel thus prepared is equal to the finest cast steel of Huntsman, has not we believe been as yet completely ascertained.

Steel is rendered hard by heating and then suddenly cooling it. The degree of hardness which it is capable of acquiring is in direct proportion to its fusibility, or in other words to the quantity of carbon with which it is combined; and the degree of hardness which in any particular instance is actually given to it, is in proportion to the difference of temperature between the medium in which it is heated and that in which it is cooled; modified however by the capacity for heat and the conducting power of the cooling medium. Thus if steel is heated somewhat below

* Journal des Mines, No. 49.

† Repertory xiv. p. 176.

the degree at which it melts and then transferred into oil at the temperature of 200°, the hardness thus acquired will be inferior to that which would have been obtained if water, or still more so if mercury, at the same temperature had been made use of. Again, if instead of oil at 200° the same fluid at 40° had been employed, a greatly superior degree of hardness would have been produced.

The hardness acquired by this method has generally been thus accounted for. The particles of the metal by being heated are placed at a greater distance from each other than before, and in proportion as this heat is again abstracted, the attraction subsisting between them will become efficacious, and they will approach nearer to actual contact; but the impetus with which this takes place will be in proportion to the difference of temperature, and therefore when red-hot steel is plunged in ice-cold mercury, the force or resilient spring of its particles will be greater than if mercury at 200° had been made use of, and consequently its hardness will also be greater. But this theory, however ingenious, is opposed by certain facts which perhaps may be found more consonant with the following explanation of them.

If we take the specific gravity of a piece of steel both when hardened and after it has been softened by heating again and gradually cooling, we shall find that its bulk in the former case is greater than in the latter, whereas if the hardness of steel was owing to the rapidity and energy with which its particles collapsed on cooling, directly the reverse of this ought to take place, the state of greatest hardness should be that of the greatest specific gravity. So in like manner we find to be the case with glass; if a little of this in a melted state is dropped into cold water it will prove very hard and brittle; but if the same piece is again heated red (without however in any degree softening it) and afterwards allowed to cool gradually, its specific gravity will have very notably increased, and it will have become tough and elastic. We may therefore consider the hardening of steel to be caused by the contemporaneous expulsion of part of its heat and the fixation of its particles before they have had time to arrange

themselves and contract upon each other. Hence on the impression of any external force, the particles that are struck are not able to slide on each others surfaces, and thus distribute the impetus which they have received over the contiguous ones; or in other words the mass becomes *harder* than it was before, hence also the whole force of a blow is borne by a comparatively small number of insulated particles, and these entirely giving way before a degree of percussion that might easily be sustained by the whole when combined, thus produce the quality of *brittleness*.

If highly carburetted steel is made nearly as hot as it can bear without melting, and is then plunged in very cold water, it is apt to fly to pieces, and even if this does not take place the metal is not applicable to any use in this state of extreme hardness, for the particles are placed so far asunder that the whole has a strong tendency to become crumbly, and will not bear a fine even sharp edge. In the practice of the best manufacturers the hardening heat even for files, which are the hardest of all steel instruments, is not greater than a red visible by day-light; and all cutting and elastic instruments require to be much softer. The various degrees of hardness necessary for different articles are not however given, as might at first be supposed, by the simple process of hardening at the requisite temperature, but by the compound method of first giving to every article nearly a file hardness, and then, by the subsequent process of *tempering*, reducing the hardness to the particular degree necessary for each article.

Tempering consists in softening hardened steel by the application of a heat not greater than that which was employed in hardening it; for this purpose it is gradually heated more or less according to the temper required, and cooled again either gradually or rapidly, this making no difference; after which the steel is found to be softened or tempered exactly in proportion to the heat which it has undergone. While the steel is tempering, its surface displays a succession of colours (supposed to arise from a commencing oxydation) in proportion as it becomes more and more heated, which the workmen in this metal have ingeniously taken advantage of, as indicating and serving to denominate the

degree of temper required for different articles. The first perceptible colour is a light straw yellow, and this being produced by a small degree of heat indicates the highest or hardest temper; to this succeeds a full yellow, then a brown, afterwards a reddish blue, then a light blue, and lastly a full deep blue passing into black, which being the other extremity of the series denotes the lowest degree of temper, and a hardness only a little superior to what the piece of steel would have acquired if when heated for the purpose of being hardened it had been allowed to cool gradually instead of being plunged into a cold liquid. The old method of tempering, and which indeed is still practised by most manufacturers, is to lay the articles on a clear coal fire, or on a hot bar, till they exhibit the requisite colour; but small articles, which were to be reduced to a blue temper, were commonly *blazed*, that is, they were first dipped in oil or melted grease, and then held over a fire till the oil became inflamed, and thus evaporated.

Some particular articles require a nicety of temper that is not very easily attained by trusting merely to the change of colour, a circumstance that induced Mr. Hartley, in the year 1789, to take out a patent for a new and more accurate method. For this purpose a mercurial thermometer graduated as high as 600°, is to be immersed in an iron trough heated by a furnace or lamp placed below it and filled with fusible metal, upon the surface of which the steel is to be laid, which may thus be tempered with great accuracy at any degree of the thermometer that the artist chooses. Oil may be substituted to the fusible metal, and the effect will be the same, except that the steel being in this case tempered beneath the surface of the liquid, and of course out of the contact of atmospherical air, will not exhibit those changes of colour which take place when the other methods are employed. The following table shows the temperature at which the various colours make their appearance.

430° to 450° indicates the several tints of straw colour, and is the temper for razors and those instruments which have a stout back supporting a keen and delicate edge.

470° corresponds with the full yellow, and is the proper temper for scalpels, pen-knives, and other fine-edged instruments.

490° indicates the brown yellow, and is the proper temper for scissars and small shears.

510° indicates the first tinge of purple, and is the temper for pocket and pruning knives.

530° indicates purple, and is the temper for table and carving-knives.

550° to 560° indicates the different shades of blue, and is the temper for watch-springs, swords, and all those instruments in which great elasticity is required.

600° corresponds with black, and is the lowest degree of temper.

One great advantage attending the use of cast steel is its uniform quality: the carbon which it contains appears to be equally distributed through every part of the same mass in consequence of the fusion that it has undergone; whereas both the natural steel and the steel of cementation are apt to contain veins of iron, either quite soft or at most very slightly carburetted, and thus a degree of imperfection and uncertainty is introduced extremely mortifying to the artist, and not unfrequently the occasion of much labour in vain. It is therefore no small benefit which Mr. Nicholson has conferred on the workers in iron and steel by publishing a simple and effectual method of ascertaining whether any particular bar is pure iron or steel, or a mixture of both.* The surface of the metal being cleaned with a file or with emery paper, is to be spread over with very dilute nitrous acid, by which the iron will be dissolved, but the carbon will remain behind untouched; after therefore the acid has been allowed to act for a few minutes, the bar is to be put into clean water and moved about in it gently, that both the residual acid and the nitrat of iron may be washed away, care being taken not to touch the surface with the hand or any thing else that may rub off the carbon. The bar thus washed, if pure iron, will exhibit an uniform iron-gray colour; if it is pure steel, the colour of the surface will be black, the iron having been taken up by the acid and a thin coating of carbon remaining; but if it is a mixture of iron and steel the surface will be dotted or streaked, those parts which are steel

* Nich. Phil. Journ. 4to. i. p. 470.

being of a dull black, and those which are iron exhibiting the usual colour and lustre of this metal.

Steel being considerably more expensive than iron, it is customary in making the larger and coarser kinds of cutting instruments to form only the edge of steel. The two bars of iron and steel are first welded together and afterwards forged into the requisite shape in the usual manner. Highly carbonized steel is however incapable of being thus united to iron, because the same temperature at which iron welds freely is that at which this kind of steel enters into fusion, and therefore the first stroke of the hammer will entirely shatter the steel and disperse it about in small fragments. This however is a difficulty which it is well worth while taking some pains to overcome, as the efficacy and durability of instruments thus composed, materially depends upon the goodness of the steel. The most effectual way hitherto discovered of uniting together iron and highly carbonized steel, is that published by Sir Thos. Frankland.* The iron is to be raised to a welding heat, in one forge, and the steel is to be made as hot as it can bear without becoming very brittle, in another; both pieces are then to be quickly brought to the anvil and made to adhere together by gentle hammering.

Several curious pieces of work are made of iron and steel welded together, especially the real Damascus sword blades, which are believed to be composed of slips or thin rods of iron and steel, bound together with iron wire, and the whole firmly cemented together by welding. The properties and external appearance of such a blade correspond very exactly with the supposed mode in which it is manufactured. Its colour is a

* The Editor can state, that no less than three experiments failed to weld Huntsman's cast steel to iron, agreeably to Sir Thos. Frankland's process, conducted in the presence of the Editor, and at his request, by the late Mr. Schively, cutler, of Philadelphia, and an expert workman. The degrees of heat prescribed for both iron and steel were scrupulously attended to.

This secret process was reserved for the United States. Mr. Pettibone, now of Philadelphia, welds cast steel to iron with ease and expedition. He even plates clothier's shears with steel, or plates iron of any length or breadth; or faces anvils, hammers, or sledges. *Editor.*

dull bluish gray, it is scarcely harder than common steel from the forge, it is not easily bent, and when bent has no elasticity to recover its original figure; but the circumstance which principally characterizes it, is the appearance of narrow waving lines not crossing each other and chiefly running from heel to point; they are ill-defined and about the thickness of a harpsichord wire. This wavy appearance is not produced by any perceptible indentation of the surface, but merely by a slight difference in the degree of polish or brightness, and therefore may be at once distinguished from the false damasking or etching by which other sword-blades are made to resemble the genuine Damascus ones. In the false Damascus blades, the waving lines, called the *water*, are obliterated by grinding, but in the real ones, although the water is at first imperceptible after grinding, yet it may at any time be made to reappear by rubbing the blade with lemon juice, no doubt on account of the unequal action of this weak acid on a surface composed both of steel and iron.*

Besides the varieties of steel that we have already described there yet remains one more, concerning which a few words will be necessary; this is Wootz.† The substance known by this name in India, is imported into this country in the form of round flat cakes, about five inches in diameter and one inch in thickness. When cold it is uncommonly refractory, neither breaking nor bending under the hammer. It is not nearly so easy to be filed as either bar or cast steel, before these have been hardened: it takes an extremely high brilliant polish; its fracture is moderately close, resembling that of blister steel that has been heated and hammered a little. When nearly white hot it is malleable, but is much more likely to crack under this treatment than even cast steel; it requires therefore much care, labour, and time, to fashion it into any required shape. When made white hot it exhibits the glassy smooth surface of welding iron, but when struck very gently with a hammer, it cracks in many places,

* Nich. Phil. Journ. 4to. i. p. 469. † Pearson in Phil. Trans. lxxxv. p. 322.

and by a harder blow is shivered to pieces. When brought to a high heat and quenched suddenly in cold water, it becomes harder than at first, though not equally so with the finest cast steel in similar circumstances; but on the other hand, it is not capable of being sensibly softened by annealing as the other varieties of steel are. At a high heat it is fusible, and after being melted exhibits a close compact grain, is considerably brittle, and bears a very near resemblance to cast steel. From its analysis and other circumstances, it is considered by Dr. Pearson as differing from steel only in containing a little oxyd of iron.

TO SEPARATE COPPER FROM SILVER.*

SIR,

I INTENDED to have deferred the present communication till such time as I should have it in my power to lay before the public the complete series of experiments in which I have been engaged with regard to the purification of gold and silver. But unluckily I mentioned a few particular circumstances with regard to them, to a man who took it upon him, without my knowledge, to send an account of them for publication to a periodical work. As I understand that work will not appear so soon as your next number, I beg, if you think it worthy of a place, that you will insert the following account of some attempts I have been making to purify the precious metals.

Being much at a loss for want of a crucible of pure silver for the analysis of some minerals, and as all the usual methods practised for purifying that metal are very troublesome, I set myself to consider the various operations on metals, in hopes of falling on a more simple way of accomplishing my purpose. At length, I found a process of Pelletier's, which promised to succeed, and mine is merely extending his idea a little further than he did himself.

* From Nicholson's Phil. Journ. Vol. xi.

He was, I believe, employed by the French government to discover an easy way of separating the tin from copper on bell-metal, and the process he gave, is this. Upon the melted bell-metal project black oxide of manganese in powder, frequently stirring the metal till all the tin becomes oxidated by the manganese. He adds a caution, not to add too much manganese, otherwise part of the copper also will be destroyed.

It immediately struck me, that in this way I might be able to oxidate the copper which alloys our silver, and upon making the trial I succeeded completely: I had some impure silver rolled out to about the thickness of a shilling, this I coiled up spirally, and put into a crucible, the bottom of which was covered with black oxide of manganese. I then added more oxide till the silver was covered, and all the space between the coils completely filled. A cover was then luted to the crucible, and a small hole left for the escape of oxigen gass. When this had been exposed for a quarter of an hour to a heat sufficient to melt silver, I found the surface of the manganese brown from the loss of oxigen; but, where the silver had been, the whole was one uniform black powder, without the least appearance of metallic lustre, so that I had no doubt, that even the silver was become an oxide.

I then put the whole contents of the first crucible into a second of a larger size, into the bottom of which I put a quantity of pounded green glass, about three times the bulk of the contents of the first crucible, and luted on a cover as before, to prevent the access of any inflammable substance.

The crucible was then exposed to a heat sufficiently strong to melt the glass very fluid. Upon cooling and breaking the crucible, I found the silver at the bottom perfectly pure, as its oxide alone could part from its oxigen without the access of some inflammable substance. I find this process answers equally well for purifying gold, and to me it seems to possess some advantages over all the former methods. The materials used are cheap, and a large quantity can be refined as soon and as easily as a small quantity, by merely altering the capacity of the crucible you use.

I tried the same operation on gold and silver in round masses,

but found it went on very slowly, and what I scarcely expected, in the first part of the process of oxidating the metals, the remaining metal continued uniformly impure or nearly so, until the whole was oxidated.

I regret that I have been forced to make this matter public, before I could do it in a manner satisfactory to myself. I wished to have given the exact proportions of alloy, manganese, and glass to be generally used, and to have ascertained if there is any truth in the old opinion, that saltpetre melted with gold destroys a part of it. I suppose that idea may have arisen from the oxigen given out by the nitre in a high heat, oxigenating the copper contained in the impure gold, which has been the subject of the experiment.

Since the above was written, I have been informed that this matter has actually been published, but know not in what work. I hope you will still have the goodness to insert this as an *original communication*, as I do not think the person who has published it will have the impudence to call it his own, and as Mr. Kirwan, and other celebrated chemists long ago advised me to publish it, I have already stated my reasons for not following such good advice.

As I have now been forced to appear before the public, I have hopes I shall be able to prevail on some of my friends to commit themselves in the same way, in the confidence that their labours will be found useful to the public.

I am, Sir,

Your's truly,

ANDREW THOMSON.

Banchory, by Aberdeen,
May 5th, 1805.

NEW, EASY, AND ECONOMICAL METHOD OF SEPARATING COPPER FROM SILVER. BY MR. GOETTLING.*

THERE are four methods of separating copper from silver, all of which require the alloy to be dissolved in nitric acid. As this acid is very dear, Mr. Goettling thought of using the sulphuric in its stead, which is comparatively very cheap. His success perfectly equalled his expectation, and the following is his method:

Having ascertained by the touchstone, or in any other way, the proportion of silver contained in the alloy, take one part of sulphuric acid for every part of silver, and for every part of copper three parts and three-fifths of a part of the same acid. Dilute the acid with half its weight of water, and pour it into a matrass on the alloy reduced to very small pieces. In order to promote the action of the acid, it is of use to put one part more to every sixteen parts of the alloy. The matrass is then to be placed in a sand-heat, and the acid brought to a state of ebullition. In two or three hours time the alloy is commonly disunited and converted into sulphate, particularly if care be taken to stir the mass from time to time with a glass spatula. This mass is thick, and frequently hard. While it is still hot, six or eight times its weight of boiling water is to be added to it, and it is to be left some time longer on the fire. The sulphate of copper will be dissolved, and great part of the sulphate of silver will be precipitated. The operator will now examine whether the whole be completely dissolved; and if it be, a plate of copper, or some pieces of copper or halfpence tied up loosely in a piece of coarse linen, must be suspended in the mixture, and the whole kept boiling for some hours. The sulphate of silver will thus be decomposed, and the silver separated in the metallic state.

To ascertain whether the separation be complete, a few drops of solution of muriate of soda are to be dropped into a little of the liquor. If a cheeselike precipitate be formed, it is a proof,

* Van Mon's Journal, Vol. 6, translated for Nicholson's Phil. Journ. Vol. xi.

that all the silver is not separated, and in this case the ebullition with the copper must be continued longer. After the whole of the silver is separated, the liquor is to be poured off, the precipitated silver is to be well washed, and the entire separation of the cupreous salt is to be ascertained by the addition of a few drops of liquid ammonia to the water with which the precipitate has been washed, which, if it contain any copper, will be rendered blue by the ammonia. After the silver is thoroughly freed from the sulphate of copper, it may be kept in the state of powder as it is, or it may be fused with a fourth or at most half its weight of sulphate of pot-ash.

The water poured off is then to be mixed with what was used for washing the precipitate, and evaporated in a copper pan, so as to obtain the sulphate of copper by crystallization. The blue vitriol thus produced will be at least equal in value to the sulphuric acid employed.

If any parts of the alloy remained undissolved, it should be separated by decantation, and reserved for a future operation.

ON THE USE OF SULPHATE OF SODA IN GLASS MAKING.*

MY object is to give some account of the attempt made by Dr. Gehlen to employ the sulphate of soda in glass-works; and as I have had an opportunity of seeing the results of his experiments, and conversing with him on the subject of those which he still intends to make, on the different substances that may be employed in glass-houses, I conceive, that the following particulars will not be uninteresting. They who wish for information more at large, may find it in the work which Dr. Gehlen has lately published, entitled *Beytrage zur wissenschaftlichen Begruendung der Glasmacherkunst*, (Attempt to establish the Art of Glassmaking on Scientific Principles,) Munich, 1810.

* Abridged ftom Annales de Chimie, Vol. 79, and translated for Nicholson's Phil. Journal, Supplement to Vol. 31.

From a number of experiments, made in the large way by Mr. Francis Baader and Dr. Gehlen, it appears,

1. That sulphate of soda perfectly freed from its water of crystallization, may be very successfully employed in manufacturing fine white glass, without the addition of pot-ash or soda.

2. That in using this flux there is a considerable gain in point of time; and consequently in the product of a given furnace, and in materials. These advantages arise from a larger quantity of silex being dissolved by sulphate of soda freed from its water of crystallization.

3. That it only requires great accuracy in the addition of the quantity of charcoal necessary to effect the decomposition of the sulphate of soda. This is so essential, that sometimes a single hundredth part too much, or too little, almost spoils the vitrification, or colours the glass. It must be observed too, that it is difficult to give precise directions for the quantity of charcoal to be employed, because the proportion must vary according to its dryness or moisture. If it be moist, it will yield more carbonic acid, which cannot certainly be advantageous to the vitrification.

4. That sulphate of soda cannot be employed so well in substance in the melting pots; but that it is better first to make a sulphuret of soda, in order to get rid of the large quantity of carbonic acid, which is formed in the disoxidation of the sulphuric acid, and would cause too great an effervescence in the melted matter.

5. That the glass-gall is decomposed by an addition of charcoal in all the other manufactures of glass, which is a great advantage, because this gall is the greatest enemy to the manufacture of fine glass.

6. That the pots, in which the glass is melted by means of sulphate of soda, must be made with much care, and with a different proportion of materials, because this glass attacks them much more than that made with pot-ash.

7. That sulphate of soda may be very well prepared by decomposing muriate of soda; and for this purpose the waste of vitriol

manufactories may be employed, which is a considerable saving.

8. Lastly, it is well known, that, when fine glass is made, and more soda or potash is mixed in it than in common glass, the glass, if not properly cooled before it is wrought, though at first very pure, begins soon to enter into fermentation while working, and afterward appears full of blebs. It is observable, that glass made with feld-spar containing pot-ash always abounds in blebs; yet it is possible to make good glass of it, and thus turn to account the pot-ash contained in it.

Experiments.

As the sentiments of Kreschmann, Pott, Laxmann, Gren, Lampadius, Van Mons, and Pajot-Descharmes, respecting the use of sulphate and muriate of soda in the fabrication of glass, differ widely, it was necessary to make the following experiments, to ascertain the processes that might answer.

1. First a mixture of quartz and sulphate of soda, in the proportions of 100 to 60, was made, and exposed to the fire of a glass-house furnace twenty-two hours. At the end of this time no vitrification had taken place, or at least it was imperfect, however high the heat was carried.

2. Quartz, sulphate of soda, and burnt lime, were taken in the proportions of 100, 100, and 15, and heated. A second mixture was made in the proportions of 100, 50, and 20; and a third in the proportions of 100, 54, and 17. The third mixture was heated in a furnace the fire of which was urged by bellows. At the expiration of four hours more vitrification had taken place, it is true, than in the first experiment; but the glass was very stiff, and as it were stony.

3. Quartz, calcined pot-ash, lime, and sulphate of soda, were mixed in the proportions of 100, 10, 17, and 43, and at the expiration of an hour and a half the result was the same.

4. Quartz, sulphate of soda, lime, and charcoal dust were mixed in the proportions of 100, 54, and 14, for the former three; and the charcoal was varied from 4 to 4·2, 4·4, and 4·5. These mixtures were left in the fire an hour, and a brownish yellow or

sometimes colourless glass was obtained, the colour always depending on the proportion of charcoal employed.

5. In the fifth experiment quartz was mixed with sulphuret of soda, obtained from carbonate of soda and sulphur heated together till no more sulphur was sublimed, in the proportion of 100 to 60.

6. In the 6th quartz was mixed with sulphuret of soda, obtained from eight parts of calcined sulphate of soda and one of charcoal dust, and lime, in the proportions of 100, 45, and 17.

7. In the 7th quartz was mixed with sulphate of soda, sulphuret of soda, and lime, in the proportions 100, 24, 24, and 17; and also in those of 100, 2·5 or 3, 45, and 17. The mixture was left in the fire an hour. These experiments gave the same result as the 4th. When these trials, and many more, the particulars of which it is unnecessary to recite, had been made, the process was attempted in the large way. The mixture was formed of 100 parts quartz, 54 sulphate of soda, 17 lime, and 5 charcoal. During the fusion, a shovel-ful of burning charcoal from the furnace was thrown in, the five parts proving too little in the circumstances that took place in the glass furnace. The general results of these experiments were:

1. That sulphate of soda may be employed in glass making, without any addition of pot-ash or of soda. The glass obtained by this process is as beautiful and as white as glass made with the usual materials, and has all the same qualities.

2. That the vitrification of sulphate of soda with quartz is very imperfect even in the strongest fire. It is more complete, if lime be added, but then it requires a great deal of time and fuel: and it is rendered perfect by the help of a substance, that decomposes the sulphuric acid of the sulphate of soda, and thus removes the obstacle, that prevents the soda from acting on the silex. The best medium that can be employed is charcoal, or for flint glass, metallic lead.

This decomposition may be conducted during the vitrification, or previous to it. The methods employed must be varied according to circumstances, but it is essential to observe, 1st, the pro-

perty charcoal has of colouring glass, even when in very small quantity; this property of charcoal not being exceeded by any of the metallic oxides hitherto known: 2dly, the preference to be given to lime reduced to powder, dissolved in water, and heated anew, before lime slacked in the air: 3dly the great effervescence of the glass when sulphate of soda is employed, an effervescence, however, not greater than sometimes arises from common soda; and hence the precaution that must be taken to add it in smaller successive portions, than if pot-ash were employed: 4thly, that the work must be carefully distributed in glass-houses of this kind, not to be troubled by this effervescence: 5thly, that sulphuret of soda may be more useful in glass-making than sulphate of soda: and lastly, care must be taken in preparing the pots, because the sulphate of soda has a particular effect, as every other flux has.

ON THE MANUFACTURE OF CHARCOAL.*

THREE brothers have established at Pellerey, near Nuits, Cote d'Or, a manufactory on a large scale, for making charcoal in close vessels.

The quantity of charcoal they obtained is double that of the usual mode, while it requires only one-eighth part of wood to be consumed in the distillation; it is also better than the common, as a given quantity evaporates one-tenth more water than the other; hence iron masters may obtain twice as much iron from the use of a given quantity of wood; and in addition to this there is also prepared a number of other articles, of each of which in order.

350 Chiliogrammes (700 *lb.*) of wood, yield 25 or 30 of tar, which retains so much acid that it is soluble in water; but when it is washed, and rendered thick by boiling for some time, it offers more resistance to water. If mixed with one-fifth of rosin it is

* From the "Retrospect of Discoveries," Vol. 6. London, 1811, p. 100. Originally published in the Annals of Chemistry, Vol. 66.

rendered equally fit for the use of ships, &c. as the common tar.

Four sorts of vinegar are prepared, all of which are perfectly limpid, which do not, like the common, contain any tartar, malic acid, resinous or extractive matter, nor indeed any mineral acid, lime, copper, or other substances. The simple vinegar marks—2° hydrometer for salts, at 12° centigrade thermo. it is stronger tasted than common vinegar, and produces a disagreeable irritation. The aromatic vinegar is prepared with tarragon, the smell is agreeable, but it has the same fault as the former. The vinous vinegar is formed by adding some alkohol to simple vinegar; it has a very sensible odour of acetic ether; the alkohol softens the flavour in some degree, but the vinegar is still very sharp. The acid, called strong vinegar, is in fact a very good acetic acid at $10\frac{1}{2}$° hydr., it is very white, clear, and sharp, without the usual burnt flavour, and seems to form the basis of the preceding kinds. It can be sold for 8 or 9 francs (7*s.*) per *lb.* which is only half the price of that distilled from verdigris. Although not so agreeable to the taste as common vinegar, these new kinds are more elegant to the eye, and do not mother.

Carbonate of soda, perfectly white and transparent, is made at this manufactory; the greatest part of this salt that is used does not require so much purification, and if the price will allow its being brought into use, 60 per cent. of the expense of carriage may be saved by drying it thoroughly before it is sent off.

The acetate of alumine that is prepared here is not sufficiently pure for the use of dyers, as it contains the sulphates of lime, and of iron, which last is very prejudicial in dyeing: but by using good alum in its preparation this might be avoided. This acetate is also turbid, and contains a white deposit probably of alumine, which ought to be avoided.

Acetate of soda in well formed, very white, and pure crystals. It is not of much use, unless physicians should substitute it in the place of acetate of pot-ash.

Acetate of copper crystallized in small grains, more brilliant than common verdigrease. It is entirely soluble in water, and much cheaper than that in present use.

Acetate of barytes perfectly pure; it would be preferable to acetate of lime for preparing acetate of alumine, if it were not too dear.

Muriate of alumine is said to be preferable to alum in dyeing, but that prepared by Messrs. Mollerat is excessively acid, and contains lime and oxide of iron, which renders it useless in many cases.

Oxide of zinc of a dirty white, and containing oxide of iron, and a little carbonic acid, which it appears to have absorbed after it was calcined.

Carbonate of zinc, rather whiter, but which also contains some iron, although the carbonic acid hides its colour.

Both the two last substances might be used by painters instead of white lead.

Besides the above, the proprietors intend to make white lead, and also sugar of lead.

A cubic metre (yard) of wood yields one hundred litres (quarts) of acid liquor, besides the above 25 or 30 chiliogrammes, (50 or 60 *lb.*) of thick oil.

Observations by the Editor of the Retrospect.—The proprietors of this manufactory seem to be perfectly aware of all the several productions which could be prepared from the refuse of their principal object; and we have no doubt but that the substances they procure in this manner will amply compensate them for the use of the capital that must be invested in building the furnaces.

The nature of the vessels in which they distil the wood is not mentioned, but they are probably cast iron retorts, or vessels of a similar nature, in which a distillation *per latus* takes place. The application therefore of Lord Dundonald's furnaces for procuring coke to this purpose would be still more advantageous.

These furnaces may be seen in an early volume of the Repertory of Arts.

Ed. Archives

STATE OF THE IRON MANUFACTORY IN GREAT BRITAIN.*

IN the year 1806, when the minister proposed to levy a tax upon the manufacture of iron, the owners of the 133 iron-works which then existed in Great Britain, deputed 14 of their number to assemble in London, and arrange the information which was submitted to the committee of the House of Commons, on the bill for imposing the tax, with a view of shewing its impolicy and ruinous tendency on a manufacture so essential to the success of almost all branches of British industry. It is through the kindness of one of these deputies that the following abstract of the iron furnaces which were working with coke or pit coal in Great Britain, in the spring of 1806, has been made public.

Cumberland has four works, containing four furnaces, all in blast; which make 1,491 tons of pig iron annually.

Derbyshire has eleven works, containing eighteen furnaces, of which only twelve are in blast, making 10,631 tons per annum.

Gloucestershire has two works, containing three furnaces, of which only two are in blast, making 1,629 tons per annum.

Lancashire has three works, containing four furnaces, of which only two are in blast, making 2,500 tons per annum.

Leicestershire has only one work, with a single furnace, which is now out of blast.

Monmouthshire has three works, containing three furnaces, all in blast, making 2,444 tons per annum.

Shropshire has nineteen works, containing forty-two furnaces, of which only twenty-eight are in blast, making 54,996 tons per annum.

Staffordshire has twenty-five works, containing also forty-two furnaces, of which only thirty-one are in blast, making 49,460 tons per annum.

Yorkshire has fourteen works, containing twenty-seven furnaces, of which only twenty-three are in blast, making 26,671 tons per annum.

* From the "Retrospect of Discoveries," Vol. 6. London, 1811, p. 100.

South Wales has twenty-five works, containing forty-seven furnaces, of which thirty-six are in blast, making 75,601 tons per annum.

North Wales has three works, containing four furnaces, of which only three are in blast, making 2,075 tons per annum.

Scotland has twelve works, containing twenty-seven furnaces, of which eighteen are in blast, making 23,240 tons per annum.

So that Great Britain contains in the whole 122 works, containing 222 coke furnaces, of which 162 are in blast, and make 250,406 tons per annum, being on an average 1,546 tons in each furnace.

There still remain eleven works in different counties, containing eleven furnaces, that still use charcoal, all of which are in blast, and make 7,800 tons per annum, or on an average 709 tons in each furnace.

From this abstract, it appears that the 133 furnaces at the period above specified produce 258,206 tons of crude iron annually, though only twelve years before the annual produce had been estimated at 100,000 tons. The number of furnaces out of blast or not working at the time, amounted to nearly one-fourth of the whole, and this circumstance is attributed in great part to the frequent repairs which the lining and hearth of a blast furnace require; and some had been blown out, or ceased to work in consequence of a temporary failure of their supply of either iron, stone, or coals, within the owner's or lessee's lands. The average produce of each of the 162 coke furnaces in blast, is 1,546 tons of pig iron. At Cyfarthfa, in South Wales, the average per furnace is as high as 2,615 tons per annum; while in 13 others the average quantity falls below 500 tons: at Dewey, in North Wales, it is stated at 150 tons only.

" The average quantity made at each of the 122 coke iron-works, is 2,070 tons per annum; seventeen of these works make 4,000 tons each or upwards; the seven largest are Cyfarthfa, in South Wales, 10,460; Old Park, in Salop, 8,359; Blackmour, in South Wales, 7,846; Pennydarran, in ditto, 7,803; Ketley, in Salop, 7,510; and Carran, in Scotland, 7,380 tons per annum;

while at the same time eleven of these works fall short of 500 tons in the quantity which they make. The three least of these are stated to be Golden Hill, in Staffordshire, 184 tons; Dutton, in Cumberland, 175; and Dewey, in North Wales, 150 tons of pig iron per annum.

Ninety-five thousand tons of this pig iron, manufactured in Great Britain, are afterwards rendered malleable. The capital employed in the manufacture of the raw materials only, is estimated at five millions; and it furnishes employment to 200,000 persons, independent of all the labour necessary to fabricate articles of iron."

Observations of the Editor of the Retrospect.—From the preceding summary it is evident, that the number of charcoal furnaces in this country has now become comparatively small, owing to the decrease of wood, and the consequent want of fuel for working them; though till about 40 years ago they were general in England, as they now are on the continent. In the reign of king James the first, this manufacture was in a very flourishing state in Great Britain; but from nearly that period the progress of cultivation became more rapid, which effected a diminution of fire wood, and a decline of the iron manufacture, as the necessary consequence. This decline was so great, that the advantages resulting from this branch of human industry were nearly lost until the process of making iron with pit coal was established, which has placed it upon such a permanent basis, that it is now capable of being extended to any magnitude without injuring the agricultural interests of the country; as the iron, though it produces so much, costs nothing that is otherwise useful, but the labour of its reduction.

In order to convey in a few words to such of our readers as are not acquainted with this subject, a general idea of the manner in which it is now conducted in this country, it may be observed, that a blast furnace of the common size, is charged 48 times, with eight bushels of coke each time, in the course of 24 hours. To produce this quantity of cokes, requires near 764 bushels of

coals per day. The furnace also consumes about nine tons of ore and limestone in the same time. The produce of metal obtained from this consumption is about 20 tons per week in summer, and 30 tons in winter, when making the best iron, or what the manufacturers call No. 1. Of No. 2, the quantity is from 35 to 45 tons per week.

At many iron works, three of these furnaces and their foundries are constantly in use; the coal and iron mines, with forges and rolling mills for making iron into bars, belonging to the same concern; the great number of steam engines, mills, waggons, horses, workmen's tools, frequently a railway or canal from one part of the works to another, a large farm to maintain the horses, and the capital necessary to prosecute such an undertaking, will give some idea of the opulence and general knowledge necessary to enable an iron master to conduct his business with advantage to the community, and profit to himself.

PAPERS ON

RURAL AND DOMESTIC ECONOMY.

CORSTORPHIN CREAM.*

THE following agreeable preparation of milk is called by the inhabitants of Mid-Lothian, Corstorphin cream, from a village of that name, where it was probably first made. It is hawked daily through the streets of Edinburgh by the name of sweet cream. The process is as follows:

Take skimmed milk that has only acquired a moderately acid taste: put it in an upright wooden vessel, (an upright churn is commonly used) having a spicket and fosset at the bottom: place that in a tub, and pour hot water into the tub till it rises nearly as high as the milk in the containing vessel. Cover the whole with a cloth, to keep in the heat. In a few hours the milk separates into two parts; the upper part assuming the consistence of thick cream, that has very much the appearance of good cream, only moderately acid; the other portion that remains is a thin watery liquid, which is of a pungent acid taste, and may be easily let off by means of a spicket; this liquid is called wigg. The cream is then fit for use. No one would believe that it did not consist wholly of real cream that had stood till it became acid. Much of the goodness of this, however, depends upon the skill of the maker; as it is greatly affected by various circumstances, particularly the degree of heat to which it is subjected, and the acidity of the milk. It is eaten with sugar as a great delicacy.

TO MAKE A RENNET.

GIVE the calf half a pint of vinegar a short time before it is killed; take the curd out of the bag, and pick all the hairs out very clean, and salt the curd and bag separately. Let them lie

* Dr. Anderson's Recreations. London, 1800, Vol. 3, p. 346.

24 hours, turning and salting them again, then put the curd into the bag, and prick holes in it with a fork. Put on the fire a pint of white wine, with a handful of Bay leaves, some mace, cloves, and allspice; give it a boil, and then put in a clean stone pot, and pour the liquor over it. Tie it up close with bladder, and in two or three weeks it will be fit for use.

TO MAKE A CREAM CHEESE.

TO one pint of cream, add a teaspoonful of the above rennet, put the curd into a cheese vat, and take the whey well from it. When it is turned in the vat, put a little salt over it, and when the cheese is drying cover it with a few nettles or strawberry leaves.

By some, a cheese made entirely of cream is deemed too rich, and that a better way is to mix the night's cream with the morning's milk. A brick and a half is weight enough to press a cheese. Some persons ripen them in hay.

REMARKS.

The perfection of every aliment or preparation into which rennet enters, greatly depends upon the excellence of that article; for the slightest taint in it, will be communicated to the preparation of milk in which it is used. The above modes of making rennet and cream cheese, were communicated to the Editor by an experienced female economist.

TO MAKE CYDER WINE.

DURING an excursion in the course of last summer, for the benefit of that greatest of all blessings, health, the editor visited the village of the religious society known by the name of the *Shakers*, at New Lebanon, New York, and there tasted a very

pleasant liquor called by them *Cyder Wine;* the receipt for which was dictated by one of the brethren, and is as follows:

After the cyder is pressed, put the pummice into a tub or vat, cover it with water, and after it has fermented or is nearly done fermenting, press it again, then distil the liquor, add three gallons of the produce of one barrel of good clear cyder of the last running. The cyder must be made late in the season; and the new compound kept in a cool cellar, and bunged tight: it will work a little, but without injury to the liquor, which becomes clear and fine. It resembles the French Frontignan Wine.

TO MAKE ORANGE MEAD.

Communicated to the Editor by a friend.

Take of Honey, - - - - - 68 lb.
Soft water, - - - - - - 17 gallons,

Whites of 12 eggs, beat up with a quart of the above liquor, while cold.

Boil the whole for an hour, skimming it from time to time. Then pour the boiling liquor on the thin rinds of 1 doz. of Seville oranges, and cover it up. When it is about luke warm add the juice of 8 doz. of Seville oranges, and of 6 lemons and their thin rinds. Stir the whole well, and cover it till it is cooled down to 96° of Fahrenheit's thermometer, when a pint of good ale yeast is to be put on a toast, and added to it. After it has fermented two or three days, or till the froth begins to sink, then strain it off from the press into a clean cask, and let it stand 6 months before it is bottled. Draw it off carefully with a syphon, without disturbing the grounds.

TO REMOVE GREASE IN PAPER.*

SCRAPE finely some pipe-clay, the quantity of which may be easily determined on making the experiment: lay thereon the sheet or leaf, and cover the spot in like manner with the clay. Cover the whole with a sheet of paper; and apply for a few seconds, a heated ironing box, or any substitute adopted by laundresses. On using Indian rubber to remove the dust taken up by the grease, the paper will be found restored to its original degree of whiteness and opacity. J. EVANS.

Bristol Mercury Office, Sept. 14, 1804.

The writer says, that he has often proved the foregoing simple method to be much more effectual than the use of turpentine: and once in particular, upon a folio of a ledger which had exhibited the effects of a stream of candle-grease and snuff for more than twelve months.

TO MAKE RICE BREAD.

[The following mode of making rice bread in South Carolina, is given by Mr. John Drayton, Esq., of South Carolina, in the 9th Vol. Repertory of Arts, p. 313.]

THE rice being washed and drained, is beaten to powder in a mortar: it is then taken out and completely dried, and finally passed through a hair sieve. The rice flour is kneaded up with a small proportion of Indian corn meal, boiled into a consistence termed *hominy*;* or it is sometimes mixed with a few boiled potatoes, to which a small quantity of leaven and salt are added. When the fermentation has been sufficiently excited, the dough is put into pans, and placed in the oven, to be baked. By this process, a light, wholesome, and pleasant bread is made.

* From the Monthly Magazine, London, March, 1810.

† To make hominy the corn must be only ground coarsely, and the outer husks or skins of the grain taken out. *Editor.*

TO BOIL RICE.

By the same.

THE rice being washed, is thrown into a small pot of boiling water, and boiled until the grains are softened, and nearly done. The water is then poured off; and the rice, covered up, remains in the pot to simmer, or more properly to steam, over a slow fire, until it becomes dressed to any required degree of dryness. The degree preferred in Carolina, is just when the glutinous quality of the rice ends, and before the desiccation begins.

REMARKS.

In order to have the rice for boiling as white as possible, it should be carefully picked (an operation which the common cargo rice generally requires) and washed in at least two waters. About one hour is required to boil the rice thoroughly; but the regularity and heat of the fire will make a little difference in the time. An unglazed earthen pipkin is the nicest utensil to boil rice in, and such are constantly used in the East Indies by the natives, who chiefly subsist on the article. An iron pot, however, answers well; but whatever utensil is used, it should be carefully *kept for that purpose solely*. Simple as the operation of boiling rice is, it is very seldom brought to table properly boiled, out of S. Carolina or Georgia. The above directions, if attended to, will always insure success. *Editor.*

TO PRESERVE FRUIT TREES, OR TO REVIVE THEM WHEN DECAYING.

THE fact of the utility of spreading refuse flax, or flax shaws, around fruit trees, has some time since been before the public,* and as every confirmation of it is important, especially

* Domestic Encyclopædia, article "Fruit."

when the delicious peach is in question, the following is given:

Sonini* says, that "the experiment has been tried on an old languishing peach tree with great success. Refuse flax stalks were spread at its foot, and far enough to cover all its roots; when it soon recovered, pushed out vigorous shoots, and was loaded with larger and better fruit than before."

ON THE FORM OF CHIMNEYS, AND ON PLASTERING THEM INSIDE.†

IT is the general and universal custom to make the funnel in a square or oblong form; which, on many accounts, is very improper. The corners of a square funnel, if ever so carefully pargeted and cleaned, contain a quantity of cold air: for the rarefied air, in its course up the funnel, never enters into them, as it always ascends in a circular form; therefore being square does not add to the width of the funnel, which, in strict truth, is only the inscribed circle. The air in the corners all the way up forming small eddies, are the occasion of the soot adhering and sticking there, which, by accumulating, forms into large knobs, and greatly retards the ascent of the smoke. These lumps occasionally detached, by frequently falling into the room, are very dangerous, by catching fire, and it is almost beyond the art of man to sweep them perfectly clean; on which account all funnels are best of a circular form.

The advantages attending a circular funnel are obvious. The air will ascend with the greatest ease and freedom; the soot will not adhere to the sides, nor will there be any vacuities for the cold air to hover about in, and it will be swept with the greatest ease. This is an object well worthy the serious attention and

* Bibliotheque Phisico—Economique, Sept. 1808, p. 161.

† From Clavering's Essay on the Construction and Building of Chimneys. 3d edition, London, 1793.

consideration of every gentleman concerned in building for his own accommodation.

The next article under this head is the pargeting, or plaistering the inside surface of the funnel, which is a very essential point; for if the inside of the funnel is not very smooth, the smoke will less or more be retarded: and where it is rough and ragged, the soot will adhere and stick to these parts, and there accumulate. The regular smoothness of the inside of the funnel greatly promotes and facilitates the ascent of the rarefied air and vapour, and lets them pass with ease and freedom to the top. It behoves gentlemen to be particularly careful that this precaution is not omitted. Workmen should have their pargeting, or plaistering, ready at hand, properly prepared with good materials, and lay it on always at a convenient height, that can easily be reached as they advance, and work it as smooth and even as possible. In the operation they should be very attentive to prevent any loose mortar falling down the funnel, from their trowel (which may easily be prevented by having a small piece of board underneath), as it will otherwise drop upon the bent part of the funnel, harden into lumps, contribute to choak the passage, and be attended with disagreeable consequences.*

Pargeting mortar, which is used for the inside of chimney funnels, ought to be made with care, in the following manner and proportion: To any quantity of the best and strongest lime, sifted fine, add one fourth part of fresh horse-dung, clear from dirt and straw: let them be well beat, and incorporated together, and used fresh made.

But we would recommend the following composition, as much preferable and more durable, if properly made, viz. To two bushels of good stone lime, add one bushel of fine drift gritty sand, and a like quantity of sea-coal ashes, or brick-dust: skreen them fine, beat and incorporate them together, for the first coat; and,

* By attention to this hint, the Editor cured a smoky kitchen chimney in his house, which had caused much inconvenience. Nearly half a bushel of mortar was chipped off of a projection in the lower part of the funnel.

when well set, put on the following for the second, or finishing coat:

Take fine white plaister (commonly called plaister of Paris) mixed with stale small beer, and work it well in a trough, or tub, to a due consistence: then lay on a fine thin coat of it upon the other, carefully worked in, and as smooth and even as possible. In a short time it will assume the hardness of stone, and a polish little inferior to marble. A funnel thus executed and finished, can never be the cause of smoke.

ACCOUNT OF A WELL FOR PRESERVING AND FILTERING RAIN WATER FOR DOMESTIC PURPOSES, WHERE A SUPPLY OF SPRING WATER WAS NOT EASILY TO BE OBTAINED.

From Nicholson's Philos. Journal, Vol. 22, p. 354.

TO MR. NICHOLSON,

SIR,

YOU may perhaps deem the following account of a filtering rain-water well, which has been successfully tried here by the Earl of Caernarvon, not undeserving of notice in your valuable Journal. His lordship has lately erected upon a dry gravelly eminence in his park, an ornamental circular building, consisting of a room and open colonades above, and apartments for cottagers upon the basement floor. Considerable discussion arose upon the mode of supplying them with water, from the depth to which it was necessary to sink, in order to obtain an effective well. My friend, Mr. John Loat, builder, of Clapham, who had furnished the plan for the construction of the dome roof, mentioned to me a contrivance of his father's to meet a similar difficulty, which had been attended with invariable success, and Lord Caernarvon immediately determined upon carrying it into execution.

Following Mr. Loat's instructions, we sunk two wells, 30 feet deep by 4 feet diameter each, which for greater perspicuity I shall call No. 1 and 2. They are a trifling distance asunder, and were

carefully clayed, to prevent percolation into the surrounding soil, and lined with bricks in the usual manner. A well secured communication was made between the two wells, by a small leaden pipe inserted two feet from the bottom. All the pipes from the roof were directed into No. 1; and an oak floor, bored full of small holes, and supported upon posts, was laid in at No. 2, just above the pipe of communication. Upon this floor was first placed a stratum of well washed coarse gravel, then one of finer, next a stratum of coarse sand, and finally one of the finest sand we could procure, making altogether two feet in thickness of silicious substances. The water, which is received into No. 1, passes through the leaden pipe into No. 2, and filtrates by ascent through the strata of sand and gravel, the space below the level of the oak floor in both wells, acting as a cespool, receives all sediment. The pump is of course affixed in the filtering well. Both wells are covered up, but plenty of air is admitted to them, through apertures made for this purpose.

You will immediately perceive, that the merit of this plan consists altogether in the filtration by ascent, with a competent space under the apparatus. The interstices of the sand are thus never clogged, and its power is preserved unimpaired for an indefinite period. The well fully answers its intended purpose, and the water is altogether excellent. I have been tempted to submit this statement to you from a persuasion, that there are few houses, which may not be made in this manner to supply excellent water in sufficient quantity for domestic consumption; and that situations abound, where the filtrating well may be resorted to with equal comfort and advantage.

I am, Sir, your obedient humble servant,

J. R. GOWAN.

Highclere, Newbury, Berks,
April 1, 1809.

*Observations by the Editor of the Retrospect of Discoveries.**

"The circumstance of the sediment remaining below the floor, and filtering apparatus, prevents it from being disturbed by the pump, and mixed again with the water.

"If we reflect upon the method which nature pursues in the filtration of water, we shall find that those waters that descend from hills, though passing through sand and rocks, are seldom pure; but that those are the most limped, which by ascending, ooze out near the foot of a mountain. The cause of this difference appears to be this: when the water descends through sand, the finest and heaviest of the particles descend with it, and gradually penetrate through the sandy strata; but on the contrary, when the water is forced to rise through sand, in order to make its escape, all such ponderous ingredients, by reason of their greater specific gravity, are left behind and settle at the bottom. The lighter particles of fluid, therefore, remain in the upper strata in both cases."

The well described above being formed upon these principles, and all filtering machines constructed in the same manner, cannot fail of fully answering the purpose intended by them. The plan will be found extremely useful in situations where rain water is preferable to well water, or where the former must be had recourse to in consequence of the depths of springs. *Editor.*

* Vol. 5, p. 172, and vol. 6, p. 491

PAPERS ON AGRICULTURE.

ON THE CULTURE AND CURING OF MADDER.

BY MR. ARBUTHNOT.

From Transactions Dublin Society, Vol. I, part I.

IF it is required to establish a plantation of Madder, to which plants must be brought from a foreign country, they must be winter plants, which are pieces of the main root on which are many buds; these are to be had in the latter end of autumn or spring, when the crop is taken up. The best method is to pack them in sand, as the buds will shoot; the ground should be extremely rich, a sandy loom, and perfectly clean; furrows should be made about a foot asunder and about four inches deep; strew the pieces of root and any of the yellow shoots, that are broken off, just sufficiently to cover the bottom, and earth them. In the month of April there will appear numberless shoots, which should be kept very clean, and a little fine mould thrown over them to lengthen the stem, which are the spring plants; when the shoots are about six or eight inches above ground, they are fit to draw, but care must be taken to pull them up with as long a stem as possible, as that becomes the principal part of the crop; the earth must be loosened by an old trowel or any such like instrument to facilitate the drawing of the plants, but it must be done with care, as in a few days time there will be a fresh succession of plants like asparagus. The above are merely directions for the nursery, which may be dug up for crop when all the plants are obtained; for the repeated pulling will so weaken the roots, as to render them not worth standing for crop; for want of this precaution many people injure their crop by drawing plants from it, instead of planting a small patch as above described for a nursery.* It must likewise be observed, that you will obtain the longest and best plants from the first

* One acre of good madder will yield plants enough for ten acres. Martyn's edition of Miller's Gardeners' Dictionary. *Editor.*

year's growth, as the original plant or mother root is much deeper, than the crowns of the plants will be by earthing.

The land for the crop should be, as for the nursery, a rich mellow loam, either hazle, or black; it cannot be too rich, and must be perfectly clean; it must be ploughed as deep as the good soil will admit of the preceding year of planting. Soil, that will not admit of ploughing eighteen inches deep at least, is not fit for madder. It must be laid up in high four feet lands before winter, that it may be sufficiently dry for working in the spring; for unless the land is in exceeding good tilth when you plant, it is in vain to attempt it.

The land should therefore have one good ploughing in the spring, partly to destroy any weeds which may have grown during the winter, as likewise to enliven the soil, but it must be when the land is perfectly dry: as soon as your plants are ready, which will be in April,* slit down two furrows one foot asunder from the crown of the land; then lay the plants against the sides of the furrows about six inches asunder, with their heads leaning to each other; this operation may be performed by women and children, who are followed by men, who with hoes cover the plants with the mould that was thrown out by the plough. Unless it is rainy weather when your plants are drawn, they should be dipped in water the moment they are pulled, and kept quite wet till planted; and, if the land is dry, it will be requisite to give a good watering the evening of the planting; for, as the plants are extremely succulent, in that proportion they dry up the faster, and will shrink to the size of a straw. If the plants do not strike immediately, they are not worth standing; they are in the greatest perfection for pulling, when small fibres begin to push all around them. As soon as you perceive, that the plants have struck vigorously, hoe the ground well round and between them,

* The American reader should recollect that this refers to the climate of England. Mr. Arthur Young says, that "though two rows on a four foot land, amount in the whole to the same as equally distant at two feet, yet they do not near equal them in product." Eastern Tour, Vol. 2d, p. 263 to 328.

Editor.

so as to loosen the soil well, and make it perfectly pervious to the young fibres; as it is the vigour of the first year's growth, which is to secure you a plentiful crop. After this operation you are only to take care, that no weeds grow during the summer, which must be by hand-weeding, and superficial hoeing; for the roots, which are the crop, must be carefully preserved from injury; therefore great care must be taken to watch and destroy moles, which always frequent rich land in search of worms, which they feed on. When weeding and hoeing the crops, draw a little light mould from the sides of the land to nourish the crowns as much as possible. In autumn, when the haulm dies, cover the whole over three inches deep, to preserve the crowns of the plants from frost, and the haulm rotting in the ground is beneficial, and keeps the ground loose; this earthing must be done from the intervals, which consequently should be occasionally worked with a light plough or horse hoe during the summer. Open the water furrows well against winter, that no water may lie. As early in the spring as the weather will permit, the whole plantation should be carefully weeded over, but great attention must be paid to the not destroying of the buds, which will be near the surface waiting for warm weather to push. Such land as I describe, being made rich, will be very subject to chickweed, and if it is not checked in time it will greatly smother the crop and exhaust the moisture from the surface of the soil. The remainder of the second year's practice should be as the first, respecting hand-weeding and slight superficial hoeing, and earthing on the haulm in autumn; indeed the more you can earth the plants in the time of growing the better, as it will produce a greater quantity of roots; but each year, you must be more careful in not disturbing the sides of the lands, as the shoots will run like asparagus; thus at last you have only a deep furrow between the lands. Some people take up the crop the second year, but I prefer three years growth: the great expense being the preparing the land, planting, and taking up the crop, I have ever found the third year pay largely for the rent and tithes; the labour of hoeing is the least, and not necessary to be so very minutely attended to, though

large weeds must not be suffered to grow. The Dutch take it up at two years old, which from their mode of planting is right; they plant very thick on beds, from which circumstance their plants cannot come to any size. But I disapprove of that method, as it is the interior part of the roots, which produces the valuable madder, consequently the larger the root, the greater is the proportion of the best quality. I have traced the age of some Turkey roots to fifteen years old; they were become a solid wood all of the best quality; these must have grown wild.

The general practice of taking up the crop is by the spade. I did it with a large plough, which struck a clean furrow of above twenty inches deep; men, women, and boys followed the plough, and threw out the roots. The dirt should be shook out of them as much as possible, then carry them every day out of the field to be dried in the shade; when perfectly dry, most of the remainder of the dirt will shake out, first beating the roots to pieces with poles or flails. They must then be dried on a kiln.*

The madder must be frequently turned, and will be dry enough for grinding in twenty four hours. The first time, that it goes under the stones, requires but a few minutes; it must be sifted, and produces a very inferior species, which is the outward coat or rind. The remainder is returned to the stones, and is kept there till the eye tells you that the interior part begins to grind, which discovers itself by the paleness of the colour. If you require the best sort to be very fine, you continue this second grinding a little longer, in short till all the rind is pulled off; it must be then sifted, and the remainder put again under the stones and ground till fine enough for use. Each sort should be casked up separately, and kept in a dry place where no moisture can affect

* Mr. Arbuthnot's kiln was thirty feet long, with numerous flues on each side, to let out the heat and moisture from the drying roots. But it is highly probable that in the United States, particularly in the southern states, a few days exposure to the sun and air would dry them sufficiently. It is probable that they would require to be covered from the dew at night; and boards ought always to be at hand to protect them in case of rain. On this head, however, let the directions of the late Mr. Lucock be consulted. *Editor.*

it; care should likewise be taken to press the madder well down in the casks.

There are various sorts of madder, differing greatly from each other both in appearance and value. The sort I prefer is the Turkey, being more vigorous, and of a darker green. It likewise produces abundance of seed, which the common sort does not; it puts out many vigorous and solid runners, whereas the runners of the common species are hollow, and produce none of the best part of the madder, which is contained in the woody part of the root.

My mills consisted of two vertical stones, that run on a bed stone, such as they use for grinding gun-powder, dye woods, &c.

AN ESSAY ON

SOAP-ASHES, AS A MANURE.

IT has been found, that the produce of soap-ashes in London, and its immediate neighbourhood alone, amounts to above 20,000 tons annually, and is likely to increase, more especially from the use of *kelp* having been lately introduced into the London markets. The Board of Agriculture having been convinced, from the most accurate information, and from experience, that this quantity of valuable manure if brought into more general use, would be an object of very considerable importance to the national agriculture, ordered an abstract of their report, on this subject, to be printed and circulated; being desirous of giving all the publicity possible, to a circumstance so well deserving the attention of *farmers*, *gardeners*, *hop-planters*, *nursery-men*, and others employed in the cultivation of the soil, more especially those in the vicinity of the metropolis, and on the borders of navigations therewith connected.

This abstract of the Report of the Board of Agriculture, published about four years since, having been widely circulated, and much considered, has deservedly attracted the notice of agriculturists in general, and has induced them to make a variety of ex-

periments with soap-ashes, on different soils, and for different crops. Many highly interesting communications, on this subject, having been made to us, we conceive it to be a *public duty* to render them more permanently useful, by publishing in a condensed, but popular form, the important facts which they contain.

This is the object of the present essay. We shall consider the subject under the following heads.

1. *The Nature of soap-ashes.*
2. *Analysis.*
3. *The soils on which soap-ashes may be used with advantage.*
4. *The quantity per acre.*
5. *The crops for which soap-ashes are used, and the manner of applying them.*
6. *The Price.*
7. *The effect of soap-ashes on grass and arable lands, in parks, gardens, &c.*

SECT. I.—NATURE OF SOAP-ASHES.

Soap-ashes differ very materially in quality, according to the sort of alkaline salt which is used by the soap-boiler. When *kelp* and *barilla* are the materials, the ashes are found to possess twice the strength and effect of the refuse of common potash. Much kelp being *now* used by the *soap-manufacturers in London*, their ashes are greatly improved as a manure; as they contain a larger quantity of neutral salt, sulphur, and carbon, than when barilla only was employed. To this circumstance, we must attribute not only the different quantities per acre that are recommended, but also the different results which have attended the use of this dressing, in various parts of the kingdom.

Soap-ashes afford a much *cleaner* manure than *dung*. A dunghill, after laying for some time, is covered with weeds; and, in using dung, the farmer generally introduces almost every sort of weed into the ground. A heap of soap-ashes is never covered with weeds, but with a *fine sweet grass*.

Some ill-founded prejudices having been formed against the

use of soap-ashes, on account of their *supposed* burning quality, a statement of the following fact, will, we think, completely eradicate them. When a piece of ground has been covered, for a length of time, with soap-ashes and dung, the verdure is naturally destroyed. Those parts of the ground on which *soap-ashes have been laid*, recover their verdure *first*, and bring up sweet grass and white clover.

In *East Lothian*, in North Britain, the farmers are very careful in collecting all the kelp weed which is cast ashore during the winter, and which they lay in heaps, upon their lands. *This is using soap-ashes in another way.* In the neighbourhood of Dunbar, where the farmers use soap-ashes, as well as the kelp weed, they pay as high a rent as *seven pounds* per English acre, for very considerable tracts of land; which are principally cultivated with wheat.

SECT. II.—ANALYSIS.

Soap-ashes contain lime partly saturated by carbonic acid from the barilla or kelp; a portion of alkali; neutral salt; sulphur; carbon; silex, and calx; each, separately, of the utmost importance to land. According to the more minute analysis of Dr. Davy, the ashes from barilla contain 91 parts in 100 of carbonate of lime, and quick-lime; and carbonate of soda. The ashes from *kelp* contain calcareous matter, in the same state as that from barilla; gypsum; and soluble saline matter, containing, apparently, nearly the same proportions of carbonate of soda, and of common salt, as in the former instance.

It is obvious then, from the chemical nature of soap-ashes, that they will be applicable wherever calcareous matter is wanted in lands, and that they will serve the purposes of *liming*. Soap-ashes are, indeed, much superior to quick-lime as a manure.

A very respectable farmer in Holderness, Yorkshire, has affirmed, that he found *ground chalk* very superior to quick-lime; this, however, from the expense of grinding it, he was obliged to relinquish. The soap-ashes and the chalk holding carbonic acid,

and the lime being deprived of it, afford a convincing proof of the superiority of soap-ashes as a manure. The alkaline salt and gypsum that they contain, will render them much better than common calcareous matter, as a top-dressing to every kind of grass.

SECT. III.—THE SOILS ON WHICH SOAP-ASHES MAY BE USED WITH ADVANTAGE.

Upon all *strong and cold soils*, soap-ashes will prove of infinite service, whether applied to the wheat crop or to cold wet pastures, particularly in Surrey. Upon the lighter loams, it is an excellent manure mixed, and in a moist season, its effects are quickly visible and permanent.* Of all the manures tried on *peatmoss*, soap-ashes answer the best.†

Soap-ashes used in *cold*, *wet*, *spongy*, meadow-land, have apparently dried it, and by the salts they contain, made it produce much greater crops of grass than before.‡

They are found very good and durable, in Lancashire, on *dry pastures*.§

On a *clayey loam*, somewhat brashy, and particularly on *cold wet pastures*, soap-ashes have been used with great success.||

Poor clay land. Soap-ashes laid on this soil, will form a *marle*. Some of the worst land of this sort, has been rendered rich and productive, by the use of this manure.

On thin, *sandy*, *and hot and gravelly soils*. It is no less remarkable than true, that soap-ashes used in these soils, will make them more firm, enrich them, and will be found to answer much better than stable-dung. Those who have never used soap-ashes have erroneously supposed, that they are not fit for dry and hot soils. This, however, is a sad mistake. Soap-ashes, like lime or salt, are, in their nature, a very cold manure, but a very rich

* Malcolm's Compendium of Mod. Husb. vol. iii. p. 177.

† Wight's Husb. Scot. vol. iii. p. 184.

‡ Bath Papers, vol. i. p. 133.

§ Lancashire Report, p. 127.

|| Communications to the Board of Agriculture, vol. vi. pp. 324, 325.

one in production. The effects of this manure will be seen by the farmer for *seven years* after it has been laid on the ground, if used in the same quantity as dung; while the latter would be more exhausted in *three years* than the former would be in *seven.*

Soap-ashes applied to *light sandy land*, operate as a binder, on account of the quantity of lime which they contain. Lime descending considerably below the surface of the earth, in consequence of repeated rains, a *bottom* is formed, and other manures are better retained. Several *liberal dressings* with soap-ashes will be required to form a good bottom; and, indeed, some time also, as most farmers use them and dung alternately.

In addition to these numerous testimonies, may be adduced the authority of that experienced mineralogist and chemist Mr. Kirwan, who considers soap-ashes to be an excellent manure.*

These ashes will prove highly beneficial to soils abounding with undecomposed vegetable substances; as, upon these, the alkaline salt will act powerfully. A confirmation of this fact may be found in the advantage resulting to peat-moss, and low spongy meadows, from the use of soap-ashes.

SECT. IV.—QUANTITY PER ACRE.

From *one hundred to one hundred and sixty bushels.*†

Mortimer, in his Husbandry, directs eight cubical yards per acre.

Mr. Arthur Young recommends *sixty* bushels per acre, to be harrowed in with turnip-seed.‡

Six loads per acre, on wet grass land.§

Seven loads per acre, on wet lands,‖ the immediate effect wonderful.

* Essay on Manures, p. 18. *Seventh Edition*

† Donaldson's Mod. Agr. vol. ii. p. 228.

‡ Eastern Tour, vol. i. p. 292.

§ Commun. Board of Agr. vol. vi. p. 324.

‖ Ibid. pp. 324, 325.

Ten loads on poor loamy land, the effect very great.*

One hundred and fifty bushels per acre, on arable land, ploughed in with seed.†

It is not surprising that there should be some slight variation in these quantities; it is not more than occurs every day in the accounts we receive of other manures. There must, of necessity, be a variation, in proportion to many circumstances, particularly the quantity of the ashes used; but above all others, the difference in the soils upon which they are spread, must occasion a diversity in the quantities established by practice. Great attention should be paid to the *age of the ashes*, as some farmers have kept them a year, and some have used them immediately. The London ashes being mostly of the same quality, a certain quantity per acre might soon be established.

SECT. V.—CROPS FOR WHICH SOAP-ASHES ARE USED, AND THE MANNER OF APPLYING THEM.

Wheat.—Mr. Mortimer, in his Husbandry, says that *six crops* of wheat running, have been taken, after eight cubical yards of soap-ashes per acre, have been laid on.

By the assistance of this manure, the ground will not only yield a large crop, but may be sown constantly, without fallowing for many years together.‡

Soap-ashes are frequently employed as a *top-dressing* to wheat, in smaller quantities than when applied to pasture, and to great advantage. They are very frequently used in Berkshire.§

In the Memoirs of the Philadelphia Agricultural Society,|| it is stated, that soap-ashes answer best for clover and Indian corn, for *wheat* and *rye*. They are used in an open fallow, put on at

* Memoir of M. L'Hommedieu, in the Transactions of the Agricultural Society of New York, vol. i.

† Memoirs of the Philadelphia Agricultural Society, vol. ii. p. 105.

‡ Bath papers, vol. ii. p. 75.

§ Commun. Board of Agr. vol. vi. p. 323.

|| Vol. ii. p. 105.

the time of seeding, and ploughed in with the seed; and have been put on after the grain has been sown with very great success, but the other method is preferred.

Barley.—When soap-ashes were harrowed in with barley-seed, the benefit was plainly visible.*

Grass Land and Clover.—One half of a field of clover was top dressed with soap-ashes: the dressed part of the field produced double the quantity of *hay* obtained from the other.†

In Gloucestershire, they are much approved for low meadows over-run with aquatic weeds. They improve the herbage, and produce abundance of white clover.‡

Dr. Cogan, formerly of Bath, observes,§ that many persons use soap-ashes in a compost, and that in various quantities. One farmer tells me, that it is often used with *road earth*, in the proportion of eighteen loads of the ashes to thirty of the earth per acre, laid on *pasture land* in the spring; but the following very interesting account will evince that the *above precaution is not necessary nor advantageous.* It was transmitted to me by a plain, sensible farmer. I shall state his practice in his own words:

"My experience of soapers' ashes is confined to the application of it as a top-dressing on pasture land. About twelve years ago, I agreed with a soap-boiler for 1,500 tons of soapers' ashes; I then agreed with an hallier, to deliver it on my farm. I used to apply about *twenty* wagon loads per acre, and a single bushing would let the whole in. I was laughed at and abused by every body for my folly,—these wiseacres alleging that my land would be *burnt up for years*, and totally ruined, &c. &c.; all which I disregarded, and applied my soapers' ashes EVERY DAY IN THE YEAR, Sundays excepted, reeking from the vat, without any mixture whatever.

"I tried a small quantity (say six acres) mixed up with earth;

* Young's Eastern Tour, vol. i. p. 292.

† Bath Papers, vol. i. p. 133.

‡ Rudge's Gloucester Report, p. 272.

§ Commun. Board of Agr. vol. vi. p. 323.

but I found it was only DOING THINGS BY HALVES, a practice I never could adopt.

"In defiance of all these prophecies my land NEVER BURNED; but from the moment of the application, became of a dark green colour, bordering upon black, and has given me sometimes more, but never less, than two tons per acre, *ever since*, upon being *hayned* (*kept up*), 42 days, viz. in May and June. The ground I so dressed was twenty-four acres: and I have had one hundred and twenty sheep (hogs of the new Leicester breed) in the ground from August last to this day, (March 2,) but I always allowed them plenty of hay. And although they were culled in August, as the *worst* I had, out of seven hundred lambs, and selected for *this* ground, on purpose to *push* them, they are now as good as the best I have."

In the communications to the Board of Agriculture,* it is stated, that in Berkshire, soap-ashes are applied to coarse, wet, grass land, in the quantity of six loads per acre, UNMIXED, with astonishing effect. The value of this manure is well known in the county of Berkshire.†

Turnips.—When soap ashes were harrowed in, at the rate of *sixty bushels* per acre, with turnip-seed, the use of them was extremely apparent; the turnips were much better than where no manure was laid.‡

This important fact is further confirmed by the practice of R. Moate, Esq. near Watford, who found precisely similar effects to result from the use of soap-ashes.

We do not hesitate to affirm that a better manure cannot be used for turnip-ground, as nothing so much promotes their growth. Soap-ashes are an effectual preventative for the *black fly* which devours all before it, and which attacks the turnips in dry weather, while they are coming up. When rain falls, this manure forces the growth of the turnips. If the ground be sown

* Vol. vi. p. 323.

† Berkshire Agricultural Report, p. 363.

‡ Young's East. Tour, vol. i. p. 292.

with wheat after the turnips are eaten or drawn off, an abundant crop will be produced. If turnip-seed be steeped in the liquor in which soap-ashes have been infused, it will be an effectual remedy for the *fly*.*

In August last (1811), a gentleman in Hertfordshire, sowed a close of seven acres with turnip-seed, six acres of which he had previously manured with soap-ashes. Although the seed was put into the ground in a bad time, the six acres produced an excellent crop of turnips; while the single acre which was NOT manured with soap-ashes, afforded no turnips that came to maturity: the few that did come up, were soon destroyed by the black fly and wire-worm.

Potatoes.—Mr. Townley, of Lancashire, tried soap-ashes as a manure for potatoes, and found the effect very great. Ground which had NOT been manured, produced one hundred and thirty-four pounds; that which HAD been manured with soap-ashes, yielded *three hundred and eighty-three pounds.*†

Mixed ashes.—Notwithstanding what has been said respecting the use of soap-ashes UNMIXED, some farmers who are in the habit of making composts may think proper to use these ashes as a material in forming these heaps, and so far as earth is concerned, there can be no objection to the practice. When these ashes are applied to *arable* crops, it seems advisable to sow and harrow them in, previously to sowing the seed, which will prevent the action of any caustic quality on the germination of the young plant. The same circumstance will point out the *autumn* as the proper season for applying them on grass lands, though experiments may be tried with them early *in spring*.

Soap-ashes are eagerly sought after at Liverpool, Hull, &c.; where they are usually mixed with pond, ditch, and river mud, and used in about four months afterwards. This, also, was the method pursued by Robert Thornton, Esq. of Clapham, who

* Transactions of the Society of Arts, &c. vol. v. p. 47.

† Farmer's Magazine, vol. iv. p. 56.

used ashes for several years, and thereby greatly improved a very *sour pasture.*

In Cheshire, soap-ashes are usually *ploughed into the land.*

The following is the quantity of *mixed* ashes per acre, used in Surrey.*

Upon strong loams for *wheat*, ten to twelve cart loads.
Upon light loams for ditto, eight to ten ditto.
Ditto. . . *barley*, six to eight and ten ditto.
Ditto. . . *turnips*, six to eight ditto.

SECT. VI.—PRICE.

The price of soap-ashes, when introduced from Flanders about two hundred years since, was as high as *three* or *four shillings* a load.

About thirty years since, soap-ashes were imported into Liverpool from Dublin; but such is uow the increasing value and extensive use of this article, that they are all used in Ireland.

In the year 1777, the Essex farmers would readily give from *twelve shillings* to a *guinea* for a waggon load, and fetch it five or six miles, and find their account in so doing.†

At Hull, ten years since, the soap-makers *paid for having their ashes taken away;* they are now sold for *twenty-four shillings* per cart load.

At Ipswich, *twenty-five shillings* per cart load, besides carriage.

In Suffolk, where the soap-makers are farmers, they will never sell any.

SECT. VII.—EFFECTS, *See also* SECT. V.—CROPS.

The various effects on different crops, will be noticed in the following order:

Wheat.—Mr. Thorne and Mr. Knivett, two principal farmers near Ealing, have used soap-ashes on *arable* land, with great success and advantage. They have taken the produce of one

* Malcolm's Compend. vol. ii. p. 177.
† Bath Papers, vol. i. p. 133.

large soap-house between them for several years. These ashes produce clean crops, with neither smut nor weeds; and not only effectually destroy, but also prevent, the approach of the *wire-worm* and *slug*, which are so injurious to wheat.

From *thirty-five* to *forty* bushels of corn, per acre, have been taken off land that had been ashed, and had produced a crop of wheat, and two crops of clover; and, that without any other help than a *single dressing of soap-ashes*. The land was so poor before, it could not have produced five bushels per acre.*

M. L'Hommedieu, in a memoir, presented to the Agricultural Society of New-York, states, that *ten loads* of soap-ashes on poor loamy land, will, in general, produce *twenty-five* bushels of wheat, per acre, which defrays the expense of raising the crop by more than one half. The land is then left in a state for yielding a crop of hay, containing from one and a half, to two tons of hay per acre, for several successive years.

Grass and Clover.—Mr. Sherwood of Abbot's Langley, has used soap-ashes with very great success, when mixed with composts.

Mr. Mansfield, near Epping, had a poor sour pasture, that would not mow, nor would stock eat it; a total change was effected by the use of soap-ashes. The soil was strong, wet, and heavy.†

Lord Suffolk, a member of the Board of Agriculture, possesses a grass field in Wiltshire, which was manured with soap-ashes nearly twenty years since, and the improvement was very great, and has continued so ever since. A line may be now drawn where the soap-ashes were used.

Robert Thornton, Esq. of Clapham, in some experiments on very sour bad pasture, amounting to seven acres, found that these ashes added one load of hay, per acre, to the crops. It produced a sweet pasture bottom, with white clover.

Mr. Packman, of Rainham, in Kent, had a sour and coarse

* Memoirs of Philadelph. Agricult. Soc. vol. ii. p. 105.

† Essex Agricultural Report, vol. ii. p. 246.

pasture; the sheep would not eat, and always had the *rot*. This pasture having been well manured with soap-ashes, produced good and sweet herbage; and the sheep became as healthy as any in the county.

In Berkshire, Mr. Billingsly says,* he has applied soap-ashes on very coarse, wet, grass lands, in the quantity of *six* loads per acre, *unmixed*, with an astonishing effect. The rushes disappeared, and gave place to a luxurient crop of trefoil; and the benefit was so obvious, *three or four years after the application*, that the eye could trace the line of separation. He pronounces these ashes to be much superior, in such cases, to every other manure.

Another gentleman says,† "on pasture ground inclined to be wet, though not sufficiently so as to require under-draining, I have seen the effect to be very striking, particularly in the *second year*. I am convinced that wet lands are preferable from the following fact. I once covered four acres of upland with these ashes, about seven loads per acre. The immediate effect was wonderful. The grass grew famously, and I cut, certainly, thirty-five hundred weight of hay, per acre; the grass came on equally well. The best time of hauling out is, evidently, when the ground is open, and the rain does not fall in such torrents as to wash it away."

A Gloucestershire correspondent, in the *Farmer's Journal* for March 30, 1812, narrates some interesting facts respecting the use of soap-ashes on old, worn-out pasture land which are a strong confirmation of the circumstance related in pp. 289–90. This correspondent observes that it is now *sixteen years* since he completed the dressing, and that this piece of land is, at the present moment, the best in the parish. He also advises the *draining* of the land before the soap-ashes are laid on. This, of course, applies only to such lands as by their excessive moisture, require the operation. The correspondent was rewarded in the year 1797, by the *Bath and West of England Society* with a pair of goblets.

* Commun. Board of Agr. vol. vi. p. 323.

† Ibid. pp. 324, 325.

Soap-ashes used on *sour pasture land*, will produce more hay or pasture than any other manure; and are equally good for dressing upland grass. If laid on in winter, this manure will produce a large crop of hay in the following summer, and will afford a greater quantity in a subsequent year. It will also destroy the COUCH GRASS, by rendering it easy for the farmer to throw out the roots.

A better article than soap-ashes cannot be laid on *clover*, in winter, and early in spring. This manure is double the value of *coal-ashes*, and will not cost half the money. Coal-ashes are not only very dear, but much inferior in quality, compared with what they were formerly. This arises, in some measure, from the immense quantity of bricks made in the vicinity of London. All the coal-ashes that can be procured, are sent to the brick makers, who pay a great price for them, and the farmer gets mere sand and dirt. If the farmer would once use soap-ashes, he would buy no more coal-ashes; for the former will not only improve his crop of clover, but greatly increase the wheat crop after the clover.

It should be particularly remembered, that the effects of soap-ashes will not be so evident in the first, as in subsequent years; and that these beneficial effects are not sudden and temporary, but certain and lasting.

Kitchen Garden.—No gentleman or gardener, who wishes to see his plants flourish, should be without soap-ashes, if he can obtain them. Where they have been freely used, they will destroy all vermin, and prevent *moles* from turning up the ground. These ashes will entirely eradicate the *grub*, which gets into the root of young cabbages, and occasions the CLUB ROOT,* or large botches and warts. This destructive evil, which greatly impedes

* Prefixed to the pamphlet are two coloured plates of Brocoli roots; one taken from one-half of a bed well dressed with prepared soap-ashes: and which bed produced fine healthy plants, with very few weeds. Another plate representing a root from the other half of the bed, dressed with dung: four out of five plants were affected by the club root, and thrown away; being in a fungous state. The bed was also full of weeds. *Editor.*

the growth of cabbages, cauliflowers, brocoli, &c. is never seen where soap-ashes have been used in proper quantities. They prevent weeds, and improve the vegetables in flavor.

Peas and beans, in fields and gardens, will be completely protected from the devastations of *rats* and *mice*, by the liberal use of soap-ashes.

Worms and Slugs.—In gardens where dung is profusely employed to force crops of *lettuces*, *radishes*, *onions*, and the like, those crops are very often destroyed by grubs and wire-worms. Were the gardener to lay up his dung in a heap, and cover it over with an equal quantity of soap-ashes, and let it remain for a month or six weeks, mixing it well together, he would have lettuces early, and of a large size, which would not be injured by worms and slugs.

Snails.—A gentleman at Fulham, who had taken great pains in cultivating a large kitchen garden, was greatly pestered with snails; so much so, that he had collected a bushel in a morning, and could not keep them under. This evil was to be attributed, in some measure, to a quick-set-hedge, which separated his land from some adjoining grounds belonging to a market-gardener. Soap-ashes were spread on a strawberry border, next the hedge; and, in twenty-four hours, there was not a snail to be seen on the border, or in the hedge. These enemies to vegetation did not return that summer or autumn; and, by occasionally using the soap-ashes, the ground is now entirely freed from snails in the most wet and hot seasons.

Wall Fruit.—If the snails are carefully picked off the wall fruit, and a quantity of soap-ashes spread on the border, under the wall, the snails will never travel over them. At the same time, an excellent manure will be provided for the borders. The truth of this statement may be easily ascertained. Place a snail upon a few of the soap-ashes; it will immediately quit its shell, and perish.

Plants.—Limed soap-ashes have a strong attraction for carbonic acid, which they separate from the atmosphere, and thus render an important service to plants. These ashes also absorb,

with avidity, the night dew in hot weather, and furnish moisture for vegetation during the day. The following singular instance will illustrate this remark. At Marble Hall, (Surrey) some soap-ashes were, accidentally, placed round the trunk of a poplar tree, to the height of four feet, and remained in that situation, for the space of three years; on removing the soap-ashes, it was discovered, that *seven new roots* had struck into them, from the trunk of the tree.

Gravel walks.—Soap-ashes laid three or four inches in depth previously to putting on the gravel, will bind the walk, render it hard and firm, and effectually prevent the worm from working through.

Parks, Inclosures, &c.—Soap-ashes have been used with much success in parks and meadows. For *lawns* they are excellent, as they produce a close, thick, clover bottom. Steeped in water, they will destroy the worm in lawns. Manure being so very scarce, they are particularly applicable to new inclosures.

Conclusion.—What an advantage would it be, if, instead of being sparing of manure, farmers would endeavour to increase their number, and to render them more beneficial, by employing them in a more effectual manner. Were this part of rural economy better attended to, and more carefully considered, we should see many places in a state of cultivation, which, on account of the bad quality of their soil, have, hitherto, resisted all our labours to render them fertile.

The expense of *rent and taxes* to the farmer, is always the same, whether his crops be large or small. How important, then, is *manure!* but, infinitely of more consequence is it, to possess a manure, which will last for a long time, and be reasonable in price. If the farmer obtain this manure, (and by using soap-ashes he will obtain it) both expense and time are saved; and crops that would scarcely pay their own charges, are made abundant and profitable.

A good dressing of soap-ashes will last in the land, three times as long as a dressing of dung.

REMARKS.

The Editor is indebted for the above essay to the author, an attentive correspondent in London. The utility of leached ashes as a manure, is well known in New Jersey and on Long Island, and by a few farmers in the vicinity of Philadelphia. The price of a single horse cart load at the soap boilers is $\frac{2}{3}$ of a dollar; it is then carted to the wharf (if destined for New Jersey, and put on board sloops and flats, and taken to the landings up and down the Delaware, and thence hauled as far as seven miles by the farmers. Great quantities are also taken to Long Island every winter, and much of the improvement there in the lands, and in those of New Jersey, has arisen from the use of this article. Three years since the Editor was informed by Mr. A. Taylor, of Buck's county, of the good effects of the ashes in destroying worms and other insects, a fact strongly proved in the preceding essay. Knowing the value of this manure, he could not but see last summer with astonishment and regret, TONS of it not used, near several pot-ash manufactories in Saratoga county, New York, although it might have been had free of cost, and the lands were in great want of it: twelve and fifteen bushels of wheat having been stated to him as the common product per acre!! *Editor.*

AN ACCOUNT OF THE GROWTH, AND PROCESSES OF MEALING, MALTING, AND BREWING, OF THE NORTHERN NAKED BARLEY.*

By R. FLOWER, *Esq.*

Marden, near Hertford,
April 1, 1810.

GENTLEMEN,

WHEN I had the honour of being present at a meeting of your Society in February 1809, amongst the many subjects then discussed were the qualities and merits of the Northern naked Barley.

* From the Letters and Papers of the Bath Society, vol. xii. p. 169. Bath, 1810

As no accurate statement was brought before you of any experiment by which its value could be ascertained, I beg leave to recommend to your attention the following account of the growth and processes of Mealing, Malting, and Brewing of the Northern naked Barley.

On the 12th of May 1809, I sowed five acres of it after a mixed crop of turnips and cabbages, which were fed off by sheep in the latter end of April and the first week in May. This crop being very abundant, kept the sheep longer on the ground, which was on this account in some degree better manured than any other land.

Although this barley was so late sown, it was ready to cut a week sooner than my English barley, and came to maturity a month sooner, which is doubtless an advantage to the husbandman, as the crop of barley on the latest-fed turnip land often suffers.

Of the produce I can only speak comparatively, as it was not large; a long drought in the summer burnt our light-land crops, and this suffered with the rest. I had but two quarters of English barley per acre; of the naked four quarters one bushel. It came up well, and had a luxuriant appearance during the dry season.

I sent a bushel of each sort of barley to a neighbouring mill, requesting each might be ground and dressed into one sort of flour; the bran only being taken out; and an accurate account of the weight of each sent to me, which was as under:

		Pecks.	lbs.		lbs.
Foreign—	Flour	2	8	or	36
	Bran	1	3		17
			Total		53 when returned from the mill.

		Pecks.	lbs.		lbs.
English—	Flour	1	10	or	24
	Bran	1	6		20
			Total		44 when returned from the mill.

Each bushel of barley lost 4 lbs. in the process of its manufacture. It will be observed that the foreign barley made 12 lbs. more of flour per bushel than the English, which is within 2 lbs. of seven pecks per quarter; and at the computed value of 2s. 6d. per peck, amounts to 17s. 6d. worth of flour more per quarter than was obtained from English barley of the last year's growth.

In the course of the winter I malted six quarters; it worked but indifferently on the floors, having many hard corn amongst it; but this I consider as the defect of almost all the barley of the year 1809. Its swell in the cistern was much greater than English barley, being from six quarters equal to our usual steeping of twenty quarters. I had also a large increase in the making, having nearly two bushels in six quarters, which is much more than it is usual to obtain from the best barley on our plan of making malt.

On brewing this malt, I had the satisfaction to find the wort tasted much richer than that brewed from my English malt.* My instrument (Richardson's Saccharometer) confirmed my observation, having extracted 12 lbs. more of saccharine matter per quarter than from the English malt.

The result of these different experiments appears to be in favour of the Northern naked Barley as follows:

	s.	*d.*
Nearly seven pecks of flour per quarter more than obtained from English barley, at 2*s.* 6*d.* per peck,	17	6
In its malted state, 12 lbs. more of saccharine matter per quarter extracted than from English malt, at 1*s.* 6*d.* per lb., ...	18	0

From this account it may be fairly presumed, that the Northern naked Barley is worth from 17*s* to. 18*s*.† more than the English, for the purposes of mealing, malting, and brewing.

I remain your obedient servant,

RICHARD FLOWER.

* Mr. Flower has since informed the secretary that the beer proves excellent.

† Per quarter of 8 bushels is meant. *Editor.*

REMARKS.

Mr. Vancouver confirms the fact of naked barley malting well, but adds that the grains must not be ground, but only cracked.*

A naked barley was introduced into Philadelphia a few years since, which yielded well, but upon the supposition that it would not malt, it has been but little cultivated of late. The foregoing accurate statement, however, not only fully proves the incorrectness of the opinion, but demonstrates the superiority of the naked barley for the purpose. *Editor.*

CATTLE SHOW.

THE eighth show and fair, held under the patronage of the Pennsylvania Society for improving the breed of Cattle, took place on Thursday and Friday, the 5th and 6th days of November last, at their establishment, BUSH HILL.

The following stock were exhibited on the first day:

1. By Joseph Burns, Esq. of New Castle county, Delaware, four fat steers, one of which was raised by himself, and supposed to weigh 1,400 cwt. alive

2. By James Caldwell, Esq. two full blooded Merino rams, three and four years old, raised by himself, and thorough bred; for very little if any difference, could be perceived in the quality of the wool on the rumps, thighs, and the neck or sides. Both were of a large size.

3. By Mr. James Clark, of Philadelphia county, two ewes and four lambs of the new Leicester breed, and one ram lamb: they exhibited all the characters of that incomparable breed, which with the Merino and Tunis breeds, will assist in effecting the revolution so essentially necessary, as far as respects form, disposition to fatten, and quality and quantity of wool, in the general

* Agricultural Survey of Hampshire. London, 1811. p. 160.

mass of the sheep of the United States. Three were sold for $70.

4. By Mr. Muller, several Merino sheep.

5. By Mr. L. Seckle, six steers, and Mr. David Seckle, 10 ditto : the average weight was from 750 to 900 lbs. the 4 qrs. These cattle were a practical illustration of the principles directed to be attended to in the choice of stock, by the Society in their address, published last spring, and formed the ground work of a lesson which every young farmer or grazier would have profited by attending to. Their forms were good, the offal comparatively trifling, and with only one summer grazing, were in capital condition. They had been already sold, and having been since brought to the shambles, proved by the abundance of fat, and its general diffusion through the flesh, the richness of the grass with which they had been nourished, and the regularity of its supply.

6. By Mr. Jervis Mudge, seventy-six store cattle from Onondago county, state of New York.

7. By Miller and Cooper, 126 fat sheep and 58 store sheep.

8. By Messrs. Samuel Richards and Joseph Hart, two promising colts, by Mr. Badger's celebrated horse Hickory.

Second day.

1. By Mr. John Hastings, of Middletown township, Delaware county, 17 sheep,—full blood, and $\frac{3}{4}$ Merino rams.

2. By Mr. Dubs, thirty head of store cattle.

3. By Mr. B. Shotwell, Sussex county, New Jersey, two twin oxen, rising 8 years. These unfortunately were of that unprofitable make, which the experienced grazier will always avoid purchasing; and Philadelphia is the last market to which such animals should be brought with a view to sale. The difference between feeding cattle of desirable forms, such as come up to, or approach to that described by the Society in their address, before mentioned, is so great, and so well known that those of the contrary description, whatever be their sizes, (and the larger the more unprofitable) are always avoided. Happily the kind

alluded to, and for which, tradition says, we are indebted to England, whence they were imported previously to the great improvement of their stock, are now seldom seen.

LARGE HOGS.

THE following is a correct account of the large hogs, whose weights and dimensions were given at p. 61, of vol. 2d, of the Archives:

	Feet.	Inches.
From end of nose to root of the tail, .	8	4
Round the midlde of the body, . . .	7	4
Round the neck close behind the ears, .	4	9
Height, ...	3	10
Weight when dressed, . 834 lbs.		
Leaf fat, ... 80		

He was four years and 10 months old: and raised by Isaac Wheaton, Cumberland county, New Jersey. This hog was one of a litter of eleven, three of which died before they reached the age of 18 months: the other seven averaged 300 lbs. before they were 18 months. The dam weighed 300 lbs.; the sire when dressed weighed 785 lbs.

In December, 1809, four hogs, raised and fed by Ellis Wright, of Burlington, New Jersey, were shown in Philadelphia, of the following weights and dimensions:

1	weighed	791 lbs.
1	.	770
1	.	742
1	.	728

	Feet.	Inches.
Height of the largest, ...	3	8
Length from the snout to the root of the tail,	9	6
Girth round the body, ...	8	8

The others were nearly of the same sizes. They were part of a litter of 18, of the English and Guinea breeds. Four or five, killed at eleven months old, weighed nearly 400 lbs. The sow when fat weighed 250 lbs. The boar was small—another proof, in addition to those before adduced, of the great influence of the size of the female on the size of the progeny. The above hogs were clean looking animals, almost white, and without that slouch look that large hogs commonly have.

Benjamin Hamlen, of Tiverton, Rhode Island, killed a hog in August, 1810, that weighed when dressed 725 lbs. The animal was 2 years 6 months old.

PAPERS ON THE USEFUL ARTS.

TOOLS TO ANSWER THE PURPOSE OF FILES AND OTHER INSTRUMENTS, FOR VARIOUS USES, MADE OF STONE-WARE. BY G. CUMBERLAND, ESQ.*

TO MR. NICHOLSON.

SIR,

TO some men, but not to you, will it appear a trifle, because very obvious on reflection, to have applied so soft a substance as clay to the purpose of lograting the hardest bodies; neither should I perhaps have ever thought of such an application in the form I now use it, had I not found, in shaping some substances, that the wear of my steel files was rather expensive.

It then first occurred to me, in ranging in thought after a remedy, that, as our stone-ware is so hard as to blunt our files, files might be as well made of our stone-ware This was about two years ago, and the first use I made of the suggestion was, to fold up in muslin, cambrick, and Irish linen, separate pieces of wet clay, forcing them by the pressure of the hand into the interstices of the threads, so as on divesting them of the covering to receive a correct mould. These I had well baked, and immediately found I had procured an intire new species of file, capable even of destroying steel; and very useful indeed in cutting glass, polishing, and rasping wood, ivory, and all sorts of metals.

The ease with which I had accomplished my purpose, as is too often the case, made me content myself with the use of my own discovery, or at most giving away a few specimens as files for ladies nails of peculiar delicacy: but having since reflected, that in glass grinding (the stones for which come from the North, and are very expensive) in flatting metallic mirrors, laying mezzotinto grounds, and a number of operations that require unexpensive friction, these stone-ware graters, if I may so call them, as not being of the exact shape of files, may ultimately become very

* From Nicholson's Philos. Mag. vol. 25. p. 257. April, 1810.

useful. I take a pleasure in furnishing you with a description of my method of applying this substance, accompanied with a specimen or two of a portable size, that you may the better be able to judge of their value to the arts, which to me, the more I reflect on them, seem the more important; as in all operations of grinding a great deal of manual labour must first be bestowed on the tool, whereas here we may mould ours in an instant, if we use a press, as in pipe making, and the expense is infinitely inferior to that incurred in constructing even the cheapest file or lograter.

I am, Sir,

Your most obedient humble servant,

Bristol, *Feb.* 10th, 1809. G. CUMBERLAND.

P. S. I have not yet tried it, not having the means just now at hand, but if a good parabolic reflector were to be impressed with a mass of stone-ware clay covered with muslin, so as to make several casts of different degrees of fineness, we might this way acquire tools, that would greatly lessen the expense of the operation of grinding; but much would depend on care in baking. Our stone ware warps but little ever.

ANNOTATION.—by Mr. Nicholson.

This ingenious invention promises to be of considerable use in the arts. The abrasion of surfaces is performed either by a toothed tool, as in filing, rasping, &c.; or by a grinder, in which cutting or hard particles are bedded with considerable firmness in a softer mass; or by scowering, polishing, &c., in which hard particles are more or less slightly retained in a soft or tenacious substance. Mr. Cumberland's instruments appear to promise great utility in the first and last of these processes; that is, they may be used either with or without a fretting powder. There are however many objections to their being used to grind speculums; not only with regard to the intended figure, but the nature of the material.

ON FREEZING WATER IN VACUO.

The following are the passages referred to by Mr. Oliver Evans, in p. 97. of the Archives, as proving the fact of his having anticipated professor Leslie in the discovery of the possibility of freezing water in vacuo. *Editor.*

WATER boils in vacuo at the temperature of 70° and vapour may by compression be reduced to the fluid from whence it arose; hence we may infer, that water will keep cooler in vacuo than when exposed to the pressure of the atmosphere. *If an open glass vessel be filled with ether and set in warm, in vacuo, the ether will boil rapidly, and rob the water of its latent heat until it freezes.* It is not right to say that the ether becomes so cold that it freezes the water around it: the heat in the water enters the ether, causing it to boil and the ether is converted into vapour, carrying off the heat to fill the vacuum. This is a positive proof that a vacuum will receive and retain, in a latent state, more heat than a plenum.

These principles may probably be applicable to useful purposes. For instance, to cool wholesome water, such as that of the Mississippi, rendering it palatable for drinking, to supply the city of New-Orleans; or of the Schuylkill to supply the citizens of Philadelphia. A steam engine may work a large air-pump, leaving a perfect vacuum behind it on the surface of the water at every stroke. If ether be used as a medium for conducting the heat from the water into the vacuum, the pump may force the vapour rising from the ether, into another pump to be employed to compress it into a vessel immersed in water; the heat will escape into the surrounding water, and the vapour return to ether again; which being let into the vessel in the vacuum, it may thus be used over and over repeatedly. *Thus it appears possible to extract the latent heat from cold water, and apply it to boil other water; and to make ice in large quantities in hot countries by the power of a steam engine.* I suggest these ideas merely for the consideration of those who may be disposed to investigate the principles, or wish them put in operation. And,

lest, I should be thought extravagant, as was the case with the Marquis of Worcester, I give a

Description of the machine.

Make an air-pump and close the lower end of the cylinder by connecting it with a globular glass vessel, if metal will not answer as well; fix the lower end of the cylinder of this pump, so that the glass vessel shall be immersed in the water that is to be cooled, and which is to be contained in a tight vessel. Near to this pump fix another much smaller, called the condensing pump, and connect it with a small vessel, called the condenser, immersed in water, fixing a valve between them. Connect the upper end of these working cylinders by a pipe with a valve therein at the top of the exhausting pump, and connect the bottom of the condenser with the glass globe, by a small pipe, in which insert a cock, called the ether-cock. The piston rods of the pumps must work through stuffing boxes made air-tight, and each piston must have a valve fixed in it, one to shut downward and the other upward: work these pistons by a lever that is to be put in motion by a steam engine or any other power.

The operation.

Fill the glass globe with ether, so that the piston will touch its surface at every stroke; expel the air from the pumps and condenser, making a complete vacuum in them. Set the machine in motion, and every time the piston rises the exhausting piston leaves a perfect vacuum behind it: the ether then begins to boil and carry off the latent heat from the water; the steam of the ether fills the vacuum, which is again exhausted by the pump, and driven into the condensing pump which compresses it in the condenser, forcing out the heat which robs the vapour of its essential constituent part, and reduces it to ether again; the ether-cock being opened just sufficient to let the ether return to the glass globe to undergo the same operation; and so on, ad infinitum. The machine might be simplified by connecting the top of the exhausting cylinder with the condenser, dispensing with the

condensing cylinder and piston. The condensation might be sufficiently effected by the exhausting cylinder and piston alone forcing the vapour into the condenser. If the air be not expelled it will be forced into the condenser, and remain above the ether formed there without injuring the working or the effect of the engine: but I presume the condensing pump would be necessary to carry the principle to such extent as to boil water by the heat extracted from cold water. A small pump may be fixed so as to be worked by the same lever, to extract the water from the vessel as fast as necessary after it is cooled. The vessel may be kept full by the pressure of the atmosphere forcing the water through a valve at the bottom.

LAW DECISION ON A PATENT RIGHT.

ON the 5th October, 1812, before his honour Judge Livingston, in the Circuit Court of the United States, at New York, came on to trial the cause of TRYON *vs.* MOREY. The attention of patentees and patent breakers, was considerably excited by this cause, and its result has given to the latter just cause of alarm. This was an action brought by a Mr. Isaac Tryon, of Glassenbury, in Connecticut, against Luther Morey of New York, for the breach of a Patent Right secured to the said Tryon, by the United States, for the manufactory of Combs. It appeared on the trial that he originally invented the Machine while a member of our revolution army, and that it was of great service in furnishing Combs to his fellow Soldiers—but from inability to defray the expenses he was prevented from procuring a patent until some years afterwards. In the mean time a description of his Machine was carried to England and there published in a number of scientific works, as an English invention—The Defendant therefore, believing, or pretending to believe, that it was not the invention of the patentee, had, for a considerable length of time, used the Machine, relying principally as the ground of his defence, on the circumstances of the description of

the machine published in England, being dated some time previous to the issuing of the plaintiff's patent. The jury, however, on the fullest evidence, decided that the patentee was the original inventor, and that he had sustained damage for 15 months' use of the same, in the sum of $500; which, being trebled by the statute, gave the plaintiff $1500.

VARNISH FOR COLOURED DRAWINGS AND PRINTS, SO AS TO MAKE THEM RESEMBLE PAINTINGS IN OIL.

From the Monthly Magazine, London, May, 1810.

TAKE of Canada Balsam, one ounce; Spirit of Turpentine two ounces; mix them. Before this composition is applied, the drawing or print should be sized with a solution of isinglass in water; and when dry, apply the varnish with a camel's hair brush.

A LIST OF THE NAMES OF PERSONS TO WHOM PATENTS HAVE BEEN ISSUED, FROM THE TWENTY-EIGHTH OF DECEMBER, 1810, TO THE FIRST OF JANUARY, 1812.

(*Continued from p.* 200.)

Inventions in 1811.

Jacob Decker, of Green, Shenango county, New York, in stills and boilers, September 2.

Stephen Strong, of Wilks township, Gallia county, Ohio, a drying house for drying fruit, &c., September 2.

Abraham Howard Quincy, of Boston, in manufacturing inkstands of stone, September 3.

Joseph Atkinson, of Amherst, Massachusetts, a water wheel, September 5.

Nicholas Turbutt, of Frederick-town, Maryland, in the common plough, September 7.

Luther Holland, of Belehuston, Hampshire, Massachusetts, a horizontal pump, September 10.

Daniel Read, of Brookfield, Madison county, New York, for spinning wool and cotton, &c., called the pleasant spinner, September 10.

Thomas Pratt, of Cheshire county, New Hampshire, a horizontal vibrating churn, September 12.

Henry Wittmer, of Lancaster, Pennsylvania, in stills, September 19.

Nathaniel Perry, of Boston, in looms, September 25.

James Rodgers, of Albany, New York, in propelling boats by steam, September 27.

Thomas Power, of New York, in stoves, September 27.

Ephraim Cutter, of Walpole, New Hampshire, a crank loom for weaving all kinds of cloth, September 27.

Alexander H. Avery, of Bennington, Vermont, in tanning, September 30.

Joseph H. Shepard, of Canaan, Sommerset county, Mass., a churn, October 1.

Moses Jaques and Henry Freeman, of Woodbridge, Middlesex county, New Jersey, in the press for pressing cotton, hay, &c., October 2.

William Humphreys, of Humphreysville, Newhaven, Connecticut, for drawing and spinning wool, October 4.

Josiah Beal, Ontario county, New York, a trip hammer, September 5.

Solomon Thayer, Braintree, Norfolk county, Mass., a pendulum mill, October 9.

Ernst Gehbe, of North hampton county, Penn., for cutting files, October 10.

Charles W. Sellers, of Alexandria, Columbia District, in manufacturing fine salt from coarse, October 11.

William Harper, of Richmond, Virginia, for breaking, swingling, and beating hemp and flax, October 15.

Jonathan Sizer, of New London, New London county, Connecticut, in circular boilers, October 15.

Jacob Pierson, of Knoxville, Knox county, Tennessee, a wooden screw press for packing cotton wool, &c., October 17.

John Vernon, of Baltimore, in cutting and manufacturing boot legs, October 21.

Archibald Tanner, of Trumbull county, Ohio, in breaking and swingling hemp and flax, October 24.

Peter Sternberg, of Montgomery county, New York, improvement in his patent fire place, October 28.

Samuel Wetherill, jun. of Philadelphia, in the mode of washing white lead, October 29.

Do. of do., in setting the beds or stacks (by admission of air) in making white lead, (a) October 29.

Do. of do., in screening and separating *in water* the corroded parts of lead from the uncorroded parts, in the process of making white lead, November 1.

Do. of do., a machine for separating the oxidated from the metallic lead, in the process of manufacturing red lead, and of the manner of using the machine, November 1.

Elisha Mack, of Sheffield, Massachusetts, a water wheel, November 2.

Lebbeus Larrabee, of Nantucket, Massachusetts, in casting metallic boxes or centres of shieves or trundles for pulleys, November 4.

Jonathan Sizer, of New London, New London county, Connecticut, a machine for basoning, hardening, and steaming hats, November 6.

Anthony Butler, of Vermont, a machine for boring posts, November 7.

Benjamin Bell, of Boston, in the process of making sulphuric acid, November 7.

William Presley Claiborne, of King William county, Virginia, for cutting wheat and other small grain, November 8.

William Maher, of Rome, Oneida county, New York, a balance water gate, November 12.

(a) The patentee carries on an extensive manufactory of white lead in Philadelphia. The painters say that the article made is equal to any imported. *Editor.*

[*To be continued in the next number.*]

Fig. 2.

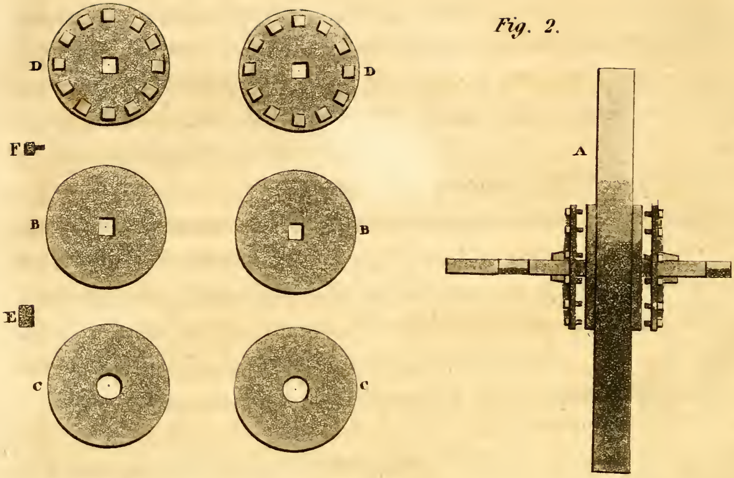
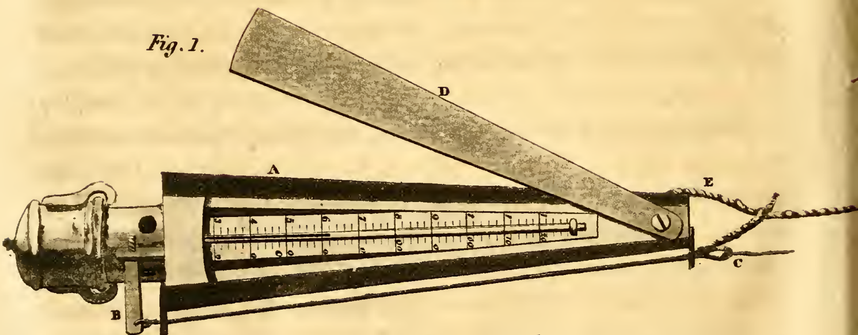


Fig. 1.



Connor's Submarine Thermometer.

ARCHIVES

OF

USEFUL KNOWLEDGE.

VOL. III. APRIL, 1813. No. 4.

PAPERS ON COMMERCE.

DESCRIPTION OF A SUBMARINE THERMOMETER,

Invented by Benjamin Connor, of Portsmouth, New Hampshire.

With a plate.

Communicated by the Inventor.

THIS machine consists of a hollow box, of a rectangular or other shape, of sufficient dimensions to admit a thermometer, and to hold a pint of water. On one side of this box is a plate of glass of sufficient thickness to bear the external pressure of the water, while the box is descending. Through this glass the height of the mercury in the thermometer may be easily seen.

From the bottom, a cylindrical shaped box projects of less diameter than the case of the machine, and having a hole or holes to admit the water.

Through the centre of the machine runs a circular rod of brass or copper, having a shoulder near the bottom, on which rests a plate of leather: round the part of the rod below this shoulder, a spiral spring is wound which rests upon the bottom of the box, to this spring a brake lever is attached, having a wire fastened to the end of it, and extending the length of the box; from thence

proceeds a line called a messenger. The glass in front of the thermometer is covered by a guard of metal screwed to the solid part of the box above, so as to permit it to traverse freely. A small hole is made in the top of the box.

When the box is used, it is let down by a cord passing through the top of it, into the water to the required depth: the cord is then slackened, and the weight of the box is supported by the messenger line, thus raising the lever below and admitting the water into the box: then letting go the messenger, and hauling up the box by the main cord, the rod is pulled down, the apertures are stopped, and the water prevented from escaping. The temperature of the water may then be examined.

References to the plate. See plate 1, figure 1.

A. The box containing the thermometer.

B. The brake lever, with the wire attached.

C. The messenger line.

D. The cover over the glass.

E. The main line.

REMARKS.

Captain Peter Bell, of Philadelphia, used the submarine thermometer during the months of September and October, 1810, on a voyage from Philadelphia to Liverpool; and again in January and February, 1811, on his return to the United States, in the ship Anna Maria: and although he made but two observations daily, viz. one in the morning, and another in the afternoon, yet he could accurately predict, by the great diminution of the temperature of the water, when he approached the Banks of Newfoundland, or got into soundings, and the lead never failed to prove the fact. He concludes his Journal by approving highly of the principle, and of the excellence of captain Connor's invention. The reader is referred to Archives, Vol. I, p. 255, for the particulars of another Journal, with the remarks of colonel Williams.

The temperature of the water should be tried several times daily.

Mr. Connor's invention is patented, and will be shortly for sale in Philadelphia, and other sea-port towns.

ON THE CAUSES OF THE DECAY OF THE TIMBER IN SHIPS, AND THE MEANS OF PREVENTING IT.*

In a letter from a correspondent.

THE advantages that England derives from her marine, whether considered as appertaining to commerce or defence, are too well known to need any comment; whatever then will contribute either to the safety or durability of the navy, becomes a matter of great public importance.

The grand cause of the decay of the timber employed in building of ships, is the decomposition of its substance by putrefaction, which is occasioned by moisture. This, precaution and management may retard, but not prevent; but a secondary one, the dry rot, may, I think, be both prevented and eradicated.

The dry rot, as it is usually called, proceeds from the growth of a parasitical plant, named by botanists *boletus lachrymans*, which belongs to the class of cryptogamia. Its injurious tendency is mentioned as far back as history will carry us, and the appearance and ravages are particularly pointed out in the Bible.† The cure there directed is, to remove the materials injured; and, if this did not stop the disease, the house was razed, and the entire articles of which it was composed taken without the city. In latter times an equally effectual but more easy remedy has been applied in buildings, where this plant has taken root; that of causing a circulation of air in the parts affected; but this cannot be introduced in the fabrics of which we are now treating.

Several means have been tried to prevent its vegetating, many of which might have answered this purpose, had they not been found to introduce evils as great as that which they pretended to cure. Among the most prominent, was the mode practised on the timbers of many ships, between the years 1768 and 1773, by saturating them with common salt; but this was found to cause a rapid corrosion in the iron fastenings, and the ships were (be-

* Nicholson's Philosophical Journal, vol. 30, p. 287. London, 1812.

† Leviticus, Chap. 14.

tween decks) in a continual state of damp vapour. *(a)* Mundic, found in the mines in Devonshire, has been lately employed, in fusion, to eradicate the vegetation, and prevent its future growth; but time is required to prove its efficacy.

In the common mode of constructing ships, there are several causes, which promote the growth of fungi. The accumulation and consequent fermentation of materials not sufficiently seasoned, divested too of a free circulation of air, and permitting sap to remain on the edges of the frames, generate carbonic acid gas to the prejudice of the timber, and which promotes the growth of this boletus. Mr. Humboldt has found by experiments, that eight or ten hundredths of carbonic acid gas, added to the air of the atmosphere, rendered it extremely fit for vegetation; and that the air in mines, and other subterraneous passages, was found in this state, which is very favourable to the germination of all plants of the class cryptogamia. The gas found in the openings between the timbers of ships affected with the dry rot has been proved, to be precisely what Mr. Humboldt has mentioned.

The means that I propose to prevent or cure this evil, are twofold: charring the whole surfaces of the timbers, and the inner surfaces of the planks, of which the ships are composed; and causing some slight deviations to be made in the modes practised in building them. I do not pretend to originality, when I recommend charring of timber, either to add to its durability, or prevent the growth of parasitical plants; for the experience of ages has proved the incorruptibility of charcoal, whether buried in the earth, or exposed to the action of air or water. The beams of the theatre of Herculaneum, which were reduced to this state by lava, were found, after a period of nearly eighteen centuries, to be perfect. The piles, supposed to have been driven into the earth by order of Julius Cæsar, when he forded the Thames at Cowey Stakes, near Shepperton, were charred, and, when recently taken up, found in a complete state, free from decay! Among many other instances, that may be adduced, the practice of burning the ends of posts to be put into the ground, to pre-

vent premature dissolution, may be added as an additional proof of the efficacy of this recommendation; and makes us lament, that it has not been generally introduced in fabrics, where so much timber, labour, and money, have been expended; and the hopes and expectations of government or individuals frequently disappointed, by their rapid decay.

There are several other advantages, that will be obtained by burning the surfaces of timber. Rats, which are so destructive to ships, will not touch charcoal; nor will the white ants and cockroaches, so common in the Indies, commit their depredations on substances so prepared. If farther evidence of its utility, when employed only on a small scale, be necessary, the durability of the Royal William, the flag ship at Spithead, which was built in the year 1719, and the planks *only* were burned on their inner surfaces, would be sufficient to prove its efficacy when practised on ships. Of late years the ends of ships' beams have been charred, and the sound state in which they are now found has justified and established the practice. Indeed all substances, that have undergone the action of fire, have been proved to be unfavourable to the growth of the boletus lachrymans; for, while stone has been rapidly destroyed by it, well burnt bricks, in the same buildings, and in nearly the same situation, have been free from its attacks.

The scarcity of English oak, occasioned partly by the improved state of agriculture, but more by the increased numbers of our fleet, has obliged this country to have recourse to wood grown in other states. The principal that have been introduced in aid of oak are the varieties of American pine: it becomes, therefore, of some importance to inquire, which sort of this timber is the most durable, and which the soonest destroyed by vegetation. Pitch pine has been used by all nations in the construction of ships, and appears to be very superior to every other species for general durability; but this wood is the soonest destroyed by fungi, as these plants are nourished by the great quantity of resin contained in its numerous cells. I have lately seen some pitch pine plank of 7 inches in thickness completely de-

composed; and, when cut open, the boletus was found to be vegetating in every part of it, but principally in the cells which were originally filled with resin. This proves how improper it will be to employ it as treenail fastenings, on which the strength and safety of ships so much depend. (b) Pitch pine should not be covered with paint, as the pores of the wood are thereby stopped, and the expansion of the resin prevented, by which means the ligneous cells are broken, and decomposition takes place. The Americans pay the topsides of their ships with a mixture of oil, resin, &c., which are not unlike the substances that are contained in the wood they cover, and produce a hard varnish, impervious to water. Perhaps the preparation recommended by doctor Parry,* to prevent the dry rot, given in the Transactions of the Bath and West of England Societies, might be introduced also for this purpose with success. White wash or lime water to be used between decks is much to be preferred to paint, both on account of its cheapness and cleansing qualities, and also as it is detrimental to vegetation.

Instead of the frames of a ship being converted to their proper shape for some months before they are put up, and afterward standing on a slip a year to season, as is now the usual practice; I would recommend, that they should be converted, and remain, together with the planks, in that state (under cover where there shall be a free circulation of air) for two years, then charred, put up, and the planking immediately begun; commencing operations from within board, by which means chips and dirt will not accumulate between the timbers; (c) care being taken, that the holes be not bored too near the seams in the outboard plank. Holes should be bored, but no treenails driven till within a short time of the ship's being launched; this will both convey air within board, and carry off the vegetable juices, if any remain in the interior of the timbers. The planks could be kept in their places

* It is made as follows: take 12 ounces of resin, 8 of roll brimstone, 3 gallons of oil, and 4 ounces of bees wax: boil them together, and lay them on while hot. [See Archives, vol. I, p. 334. *Editor.*]

by the usual butt bolts, and some copper nails, or small bolts ragged, being driven at intermediate spaces. This too would strengthen the ship, as metallic fastenings are always to be preferred, in the wales and bottom, to treenails.

An objection may be made to the bringing round thick planks in the bow of a ship by burning, rather than the usual practice of boiling them in a kiln, on account of breaking their fibres. Although I do not see, that any difficulty can exist in the former method, as it is the usual practice of the French; yet, if any should occur on trial, and boiling them be considered absolutely necessary, vegetation may be prevented by dissolving some green vitriol in the water, and afterward fixing it in the wood by a weak alkali. The method approved of by many judicious shipwrights, and constantly practised by the Dutch, that of sawing the thick planks, that are to be much bent, into two parts, might also be employed for this purpose. If a doubt should exist of the efficacy of wood prepared in these several ways to prevent the dry rot, specimens might be placed in a ship almost destroyed thereby, such a one as I recollect to have seen at Woolwich about 13 years since, which was in so bad a state, that the decks sunk with a man's weight, and the orange and brown coloured fungi were hanging in the shape of inverted cones from deck to deck. A few months trial of wood put into a ship so infected would prove the efficacy of either mode of preparation.

Drying of timber in an oven, as recommended by Fourcroy, is also likely to add considerably to its durability.

One farther precaution is necessary. After a ship is built, she should lie at least six months in ordinary, with her hatchways covered to prevent the admission of rain water; some planks should be removed in the ceiling, and above the waterways of the several decks; and fires constantly kept in stoves, placed in the hold, and on the decks; by which means the moisture, that the charcoal may have attracted, will be dissipated, and the durability of the fabric insured.

Having stated these general circumstances with a view to prevent evils, which yearly exist to a great extent in the navy; I

trust it will be the means of calling forth the opinions and abilities of those, whose minds have been directed, or whose occupations may lead them, to a consideration of this important subject.

I am, &c. &c.

11th November, 1811. NAUTICUS.

NOTES BY THE EDITOR.

(a) The experiment of pickling ship timbers, by immersing them in brine, was tried, with very injurious effects in the frigate United States, built in 1797, in Philadelphia: their decay being rapid and extensive in about one year or a little more after she was launched.* She has been repeatedly repaired since. Other causes may have contributed, such as the closeness of the timbers, and the plan adopted of driving down pieces of pine between them, by which all circulation of air was completely prevented.

(b) There is another reason why neither pine treenails, nor pine on any occasion should come in contact with oak; and this is, the destruction of the pine by the acid of the oak. This important fact was discovered by colonel A. Anderson, of Philadelphia, by using pine and oak in the large worm tubs of his distillery, and communicated to the editor many years since; the same effect was perceived, and from the same cause, in the great wooden boiler at the Centre-Square Steam Engine House, Philadelphia.†

This boiler was made of white pine, four inches thick, and oak timber used to support the sides, bottom, and top of it. In

* Filling the spaces between the timbers with salt, has the opposite effect, of preserving them, however unseasoned when put in: and since the publication of the last No. of the Archives, in which the practice was recommended, several instances in addition to those therein stated, have been mentioned to the Editor, of vessels belonging to Philadelphia, which were thus salted, and that have lasted from 20 to 30 years.

† Mr. Latrobe, on Steam Engines. Transactions American Philosophical Society, vol. 6, p. 94.

less than a year it was discovered that the substance of the pine plank, to the depth of an inch was entirely destroyed.

In Philadelphia, the *treenails* used are almost invariably made of the white flowering locust, (*Robinia pseudo-acacia*). This valuable tree should be prohibited from *wanton destruction*, by a law in every state in the union.

(c) The operation of "*chipping*" is of great importance in preventing the decay of a ship, and is too often neglected by the carpenters either from carelessness or design. It means, to clear out all the chips made on board, and that fall to the bottom of the vessel. This duty ought to be attended to and faithfully performed before the vessel is ceiled, for the chips by being permitted to remain, generate moisture, foul air, and mould, and decay in consequence will ensue. The correctness of these remarks must be obvious to all who know any thing of shipping, but their weight will probably be increased, by its being known that they come from one of the most experienced ship-masters in the port of Philadelphia.

INSTRUCTIONS FOR TRAVELLERS.*

IF you travel by the stage coach you should engage your place some days before your departure, to prevent being disappointed, and thereby deceiving your distant friends whom you may have informed by post, when and where to expect you.

In chusing your seat, ascertain in winter on which side the wind is, and in summer, which side will have most of the sun during the day, that you may regulate your place accordingly.

If you travel on horseback, and intend a long journey, you should give your horse fresh shoes. If you hire a hack, do not chuse one for handsome appearance, but examine attentively whether his sides have been much galled by spurs, in which case you may be sure he is a slow stubborn beast, and will occasion

* Translated for the Tradesman, London, May 1809, from a foreign work.

great fatigue and trouble to his rider. Observe also, in what state are his knees, as these will be a sure presentiment if he is sure footed or not.

The next precaution our author gives, is respecting the saddle, advising every traveller to have his own; as much depending on an easy saddle for accomplishing a long journey, as on the goodness of the horse.

He recommends the following method of keeping yourself warm, if travelling in a stage coach during severe nights: besides having the feet in straw, burn a wax taper, and it will be soon found to have rendered the coach as warm as a small room with a fire therein.* Persons travelling on horseback are recommended to use very light food, particularly when riding after dinner, and that the principal meal should be made at supper.

Another salutary precaution recommended to travellers, is always to burn a light in the chamber of the inn where you put up at, and as lamps are not always attainable, the following method is recommended, for substituting a piece of candle, so as to cause it to burn three times as slow as usual; whilst your candle is alight, form around the wick with the point of your knife, a line of fine salt resting upon the tallow, and the point finishing at the flame, this will cause it to burn very slow, and the salt will descend gradually as the tallow is consumed.

After returning from a journey, to take off the tawney complexion from the face or hands created by the weather and sun beams, washing in cold spring water with a diffusion of vinegar, is recommended every morning, as an infallible and speedy remedy.

It is much to be regretted that some few among the many persons travelling for business, from years end to years end, through the greater part of Europe, have not been induced to add some-

* The Editor was lately informed by a gentleman that he burnt two wax candles in his carriage, when travelling in Russia, and found that he was thereby kept very comfortable. The carriage was much closer than common, and he was also enveloped in furr, but notwithstanding these precautions he had previously suffered much from the cold.

thing towards the *useful* and *agreeable*, of their countrymen who stay at home; there is not a place, however insignificant to the passing stranger, but what will have some object or circumstance connected with its local history, worthy of being observed and recorded; the manufactures of the various districts alone would present a wide field for display, not only for the object of curiosity, but improvement perhaps of similar branches at home, where the working manufacturer has not time or opportunity of travelling for instruction.*

No travellers are better versed than the English in the different branches of trade and commerce to which they belong, but beyond that, they have no conception of enquiring. A commercial traveller has many advantages in his favour for an introduction to persons and things, that even the independent gentleman travelling with letters of recommendation in his pocket has not. The traveller will see every thing with the face of nature, but the gentleman through introduction will only be shewn the brightest figures. In visiting manufactures the traveller will be enabled to observe, and record in a more scientific and accurate way than the visitor, retaining only a part of such description as they are pleased to relate to him: and trade and business have such connections, that they will get free access when every other traveller would be denied.

ADDITIONAL RULES, BY THE EDITOR.

IN travelling in a post chaise in France, the carriage should be the property of the traveller, and ought to be carefully examined before setting out, in order to insure its strength; for the common hacks are worthless vehicles, and very unsafe. Horses are to be procured at every stage agreeably to a law.

It may be well, nevertheless, to provide a hammer, some strong nails, a jack knife, and several yards of bed cord, in case of breaking down, to enable you to mend a broken spring or shaft, without being obliged to call in the assistance of the country people,

* This hint will apply with much force to the numerous Americans who annually scamper over Europe. *Editor.*

who will infallibly take advantage of the traveller, and charge most enormously for services, for which imposition no redress can be had.

The traveller should endeavour to regulate his stages so, as to enable him to reach that at which he intends to stop all night, before, or about sun down, especially if the weather be bad or unfavourable: and previously to unharnessing, or taking off the baggage, he should enter the inn, and make his contract with the landlord for his accommodation, otherwise he will, in all probability be grossly imposed upon. If the demand be exorbitant, the traveller may proceed to the next stage, or if the weather be fine, and the country not interesting, he may go on still further.

When about to enter a new government, or new country, it will be of great importance to take that kind of coin which passes there. Therefore procure it previously to setting off, taking care to avoid false coin, or light gold.

The reader is referred to *count Berchtold's essay* to *direct the enquiries of Patriotic Travellers*, and to *M. Starke's letters from Spain*, for further hints.

ON SEA VOYAGES.

THE following directions for those who are about to undertake a sea voyage will be found useful to young travellers. Although in direct reference to a passage from England to America, their application is extensive. They are taken from "Cooper's information respecting America. London, 1795."

A SPRING passage will be cold, and therefore the best bedding is a feather bed cut in halves, which supplies two births—In summer, a mattress so treated will be pleasanter than a feather-bed. In spring, provide yourself with a cloth jacket and trowsers; in summer you should have two or three nankeen or other light jackets, and three or four pair of cotton or linen trowsers. A black cravat will be full as convenient on board ship, as a white one.

You should calculate upon a passage of ten weeks from London (which is usually a week longer than from the western ports

of Great Britain) and although you will most probably not be above seven or eight weeks from port to port, it will save you some trouble if you pack up your linen before hand, upon this calculation, for you will have changes ready, without the necessity of opening your boxes immediately.

Let your linen be put up in weekly parcels; for instance, two or three shirts, or two or three pair of stockings, two or three handkerchiefs, and a towel or two. Of these parcels make ten, and you will find it readier, than running to your trunk every time you want to dress yourself.

Take care that the captain has a filtering stone, or some other machine for the same purpose, for the use of the cabin passengers. Should your water, notwithstanding, smell somewhat offensively, which in summer time it will do, this may be remedied by some powder of Charcoal. If there is no filtering stone, the mere particles of dirt will be easily thrown down and the water cleared, by putting about a tea-spoonful of a solution of alum into a pint of water, which in a quarter of an hour will be very clear, and its wholesomeness not in the slightest degree impaired.

Take care to provide yourself with lemons, apples, or any other fruit that will keep; you will find them very grateful, especially after sea sickness. This latter complaint is not dangerous, and is better submitted to than prevented. It goes off earlier by *exercise upon deck in the open air than by staying below in the cabin;* and it is better cured by gentle dilution, than by loading your stomach with food, or by any preventive or curative medicines. On landing, your health will be better for having been sick at sea. This is, at least, as true with respect to females, as the male sex, generally speaking.

Sickness and want of exercise are apt to induce costiveness: this should be guarded against by the laxative medicines you are accustomed to use. This tendency is increased by much animal food and porter, and even the usual quantity of wine. Englishmen are too apt to live in hot weather and southern climates, as they do in the cold and rainy winters of their own country.

A sea voyage is very tiresome. Take, therefore, books, and cards, and chess, and draughts, if you play at those games.

With respect to the articles worth taking with you for your own use in America, I think the best general rule is to take whatever you can pack up in a box, or a chest, keeping an account of the contents. You may take even your glasses and your crockery. Stock yourself with linen, but you need not over stock yourself with other wearing apparel. Carry enough, however, for a twelvemonth at least.

The following observations and hints on sea voyages, are abridged from a paper by Dr. Franklin.

"It is not always in ones power to chuse a captain, though a part of the pleasure and happiness of the passage depends upon the choice. If he is a social sensible man, obliging, and of a good disposition, you will be much the happier. However if yours is not of this number, if he be a good seaman, attentive, careful and active in the management of his vessel, you may dispense with the rest.

"It is always proper to have some private store, which you may make use of occasionally. Provide good water, and put it in bottles. Carry good tea, ground coffee,* chocolate, wine, cyder, raisins, almonds, sugar, capillaire, citrons, rum, eggs dipped in oil, portable soup,† *bread twice baked.* Dr. F. most humanely adds, that if not wanted, they may be disposed of among the steerage passengers who may be sick, melancholy or dejected.

"Cyder is the best liquor to quench the thirst arising from eating salt beef."

* This should be very closely packed in tin cannisters, in order to preserve its flavour. *Editor.*

† See p. 220.

ON SEA SICKNESS.

THE editor has had many opportunities to confirm the fact stated by Mr. Cooper, of the improvement in the health of persons, who have been very sea sick. A thorough evacuation of the stomach and bowels ought therefore to be encouraged; but in persons disposed to sea sickness, the stomach may take on a diseased action and cause great distress and emaciation. Remedies should therefore be tried, and the following are recommended.

Cold chamomile tea, taken in small quantities at a time, and frequently repeated. Preserved ginger, or ginger or cinnamon tea, occasionally taken, will prove very grateful. The diet should be cordial and nourishing. In a rough passage along the coast of the United States of several days, the editor suffered severely from the complaint; and after its violence had somewhat abated, a tea spoonful of fine old brandy, mixed with a wine glass full of water and sipped occasionally, proved highly refreshing and salutary. Ratifia taken in small doses, also contributed to his recovery. Split rusks dried are more relished by those who are sea sick than any other kind of bread: and when soaked in claret and water, or port wine, on which a little nutmeg has been grated, will be found very reviving. Preserved cranberries ought to form a large portion of the ship stores of every one leaving America, who consults his comfort in a voyage, nothing being more agreeable as an article of diet sick or well.

A writer in the Monthly Magazine of London, vol. 6. p. 2. advises persons subject to sea sickness,

"1. To take exercise at the pumps.

2. Keep much on deck.

3. Not to watch the motion of the waves.

4. Seek opportunities of mirth.

5. To drink occasionally of liquors containing fixed air, as wine mixed with Seltzer water and sugar, spruce beer, champagne, froth of porter." To these may be added, fine cyder, (in a glass of which a few grains of potash should be dissolved); and drank in a state of effervescence. Artificial soda waters, preserv-

ed in stone bottles, which may now be had in most American sea port towns, would be an excellent drink to restore the tone of the stomach.

"6. To use dulcified elixir of vitriol in water dropped upon loaf sugar, or in peppermint water, or ten drops of sulphuric ether.*

7. Spare diet, bread and fresh meat, eaten cold with pepper, avoiding sweet savoury food and fat: drink little and often.

8. *Keep the bowels open.* If the sickness does not cause an evacuation of the bowels, and the stomach rejects medicine, clysters should be injected daily, composed of a pint of warm water, a spoonful of common salt, two do. of sweet oil, and two do. of molasses or of coarse brown sugar. This remedy promises much relief, by counteracting the costive habit which a sea voyage has a tendency to produce.

9. Apply to the pit of the stomach, a tonic and anodyne plaster.

10. Compress the stomach by tying a bandage round the body.

11. Keep warm and promote perspiration."

Another authority† adds, "the first and greatest of all preventives of sea sicknesss, is the acquiring the habit of walking and standing upright without reeling to and fro, for it is my opinion, and I speak from experience in my own person, that the continual reeling motion of the body is the real cause of sea sickness."

* Care must be taken to avoid approaching to a candle nearer than three feet with the ether. *Editor.*

† Monthly Mag. vol. 7.

METHODS FOR SAVING LIFE, IN CASE OF SHIPWRECK, OR OVERSETTING OF VESSELS OR BOATS.

By Mr. G. Cumberland.*

ABOUT six years past, a solitary inhabitant of a promontory projecting into the Severn Sea, called Weston Super Mare, I amused myself much among the rocks there, and spent many hours studying the action and form of water when impelled in the figure of a wave; it being my opinion at that time, as it still is that the forms water takes from motion are so determined, that even in sculpture they may be represented with correctness; and that nothing would better teach us the art of representing motion by fixed lines, than these images so often repeated with exactness. On these occasions I frequently observed extensive masses of the sea weed called tang on that coast, and which the farmers burn for manure, floating into the hollow coves below me, on the surface of the most tremendous waves; and forming, if I may so express myself, a green carpet, that, undulating on the broken wave, was never submerged, although continually varying its surface; and on which, as on a resting place, birds frequently alighted, or sat to repose themselves, as if it were a verdant down.

On a coast so remarkably dangerous, where no boat could land even in comparatively tranquil weather, these *safe rafts* were very interesting, and led naturally to the thought, whether such a sort of raft might not be constructed of other materials, fit, instead of birds, to carry men. The result of which was, it appeared to me, that if each sailor in a man of war had a cork mattress, and these mattresses were all linked together by cords, such a float, capable of landing safely even on breakers, would be produced.

Pleased with the thought I went to Bristol, and consulted a cork cutter there as to the quantity of cork necessary to support a man; and soon found, that a very moderate weight would do, and that cork shavings were then worth only 8*d.* per bushel, and chiefly sold for firing, or to make guards for privateers to fill the nettings.

* Nicholson's Philos. Journal, Vol. 26.—1810.

It therefore struck me, that, as mattresses are necessary in the navy for the hammocks, and nothing dryer than cork or easier to shave into a thin elastic body, it might answer the above end, to fill these mattresses with this substance, in a proportion equal to the support of a single man: and then a mass of them thrown overboard linked together by ties at each corner, where cords might be always attached, would form an extensive raft, capable of sustaining, out of the water, as many men as there were of these mattresses united; and thus conveying them on the tops of the waves, and depositing them safely on shore, or even on the surface rocks, when the sea retired with the tide.

To contemplate such a thought in imagination is truly delightful; but to believe, as I do, that the thing is practicable with ease, and not communicate it to others, is impossible. I have therefore done all in my power to extend the idea from my own bosom to the mind of the public at large, having first addressed my wishes and plan to that quarter, where the power of putting them extensively into execution alone exists.

BY MR. H. LAWSON.*

The absolute necessity that assistance to persons in danger of drowning should be speedy to be effectual, induced Mr. Lawson to consider what articles were most readily and universally to be found at hand in all cases, which could be converted into a floating apparatus, either for the use of the person in danger, or those who might venture to his assistance. What seemed to Mr. Lawson, in a great measure to answer all those conditions, is the buoyancy afforded by a common hat reversed on the water, which will thus admit of being loaded nearly with ten pounds weight before it will bear seven pounds with safety; and as the body of a man is about the same weight as the water, a buoyancy equal to seven pounds will effectually prevent his sinking. To render the hat still more manageable for this purpose, and less liable to fill with water by accidents, Mr. Lawson recommends, that it

* Tilloch's Philos. Mag.

should be covered with a pocket handkerchief laid over its aperture and tied firmly on the crown: Mr. Lawson asserts that with a single hat prepared in his manner, held by the tied part, a man who even does not know how to swim might venture safely to assist one in danger.

When two hats can be had, Mr. Lawson recommends that a stick be run through the tied parts of the handkerchiefs which cover them: and if more hats could be got, it would be still better; four hats may thus be fastened to a common walking-stick, which will thus sustain at least 28 pounds.

When a stick is not at hand, another pocket handkerchief tied to the lower parts of those which covered two hats, would thus unite them like a pair of swimming corks, and make them equally convenient.

If a man happen to fall out of a ship or boat, he may support himself till he can get assistance, by turning his hat upon its crown, and holding by its brim with his two hands, so as to keep the hat level on the water.

Observations.—The number of accidents that happen every year both to swimmers and skaters (the more melancholy, as the sufferers are generally in full health and vigour, and often in the midst of gaiety and frolic), make Mr. Lawson's contrivance, for affording instant relief in all cases, very valuable; and should therefore obtain them notice in every publication where they can be admitted.

The following hints, on the same subject, were originally inserted in the Mercantile Advertiser of New-York.

The following experiment I have tried, and have no doubt it would be the means of preserving the lives of such of our seafaring people as should be so unfortunate as to abandon their vessel and entrust their lives to the boat.

A fourteen feet boat, with an empty puncheon lashed to the rising of the boat on the inside, will float with 4 men in it when full of water, and in that case may be bailed out.

And I believe that one puncheon to a ton, or four puncheons to a twenty feet long boat, will float with sixteen in like manner.

In the above case a boat may live in the sea, without turning bottom up.

WILLIAM THOMPSON, Brooklyn.

Some Account of MR. DANIEL's Life-preserver.*

THE body of the machine, which is double throughout, is made of pliable water proof leather; large enough to admit its encircling the body of the wearer, whose head is to pass between two fixed straps, which rest upon the shoulder: the arms of the wearer pass through the spaces on the outside of the straps; one on each side, admitting the machine under them to encircle the body like a large hollow belt; the strap on the lower part of the machine is attached to the back of it, and by passing betwixt the thighs of the wearer, and buckling, holds the machine sufficiently to the body, without too much pressure under the arms. The machine being thus fixed, is inflated with air by the bearer blowing from his lungs, through a cock affixed to the machine, a sufficient quantity of air to fill the machine, which air is retained by turning the stop-cock. The machine, when filled with air, will displace a sufficient quantity of water to prevent four persons from sinking under water.

The following directions to Pilots and others, who have the management of undecked boats, were published by "An old Seaman," a few years since, upon the melancholy occasion of a boat being overset, going from Quebeck to Orleans, by which a valuable life was lost.

1. "Reduce the size of your sails. I have generally remarked that they are greatly disproportioned in this respect to the size of your vessels. 2. By no means ballast your boats with stone, iron, or such like matter. 3. Always keep on board, and which you may stow away under your benches, a convenient num-

* From the Annual Report of the Royal London Humane Society for 1809.

ber of casks of 20 gallons each, so as when filled with water, to enable your boat to be stiff and carry sail. With this precaution, if a sudden flaw of wind should upset the boat, she will float with the casks, and the persons on board may save their lives; and even one such cask will be sufficient to save the life of a man. If the ballast be of stone, the consequence is, that when overturned, she must go down with all on board. 4. Another advantage arises from water-cask ballast, which is, that when you are becalmed, you can discharge the water from the casks overboard, and have a light vessel to row: whereas if you carry stone ballast, and are long becalmed, and wish to have a light vessel for conveniency of rowing, you by throwing it overboard render the boat unfit for carrying sail when a fresh breeze springs up, and by this means are unable to reach the shore. 5. Always keep a funnel on board for filling your empty casks. 6. Your boat, when water-ballasted, sails much more lively, especially in rough water, than when ballasted with stone."

RELATIVE VALUE OF GOLD AND SILVER COINS.*

		Sterling.		
France.	Louis, coined before 1786 .	£. 0	19	10¾
	do. since " . .		18	10
	Napoleon, or piece of 40 Francs	1	11	8
Hamburgh.	Ducat, ...		9	4½
Holland.	Ducat, ...		9	4
Portugal.	Moidore, ...	1	6	11¼
Rome.	Sequin, ...		9	3
Spain.	Pistole, or doubloon of 1801, .		15	11½
United States.	Eagle, ...	2	3	6
	Half and quarter eagles in proportion.			
India.	Mohur of Shah Allum, 1787, .	1	13	4½
	Sucat Mohur, latest coinage, .	1	9	2½

* From Kelly's Universal Cambist, 2 vols. 4to. London, 1811.

SILVER COINS.

		Sterling.		
France.	Ecue of six livres, ...	£0.	4	$8\frac{1}{4}$
	Piece of 5 francs, 1808, Napolean, (100 cents)		4	$0\frac{1}{2}$
	Franc of 1809, ...			$9\frac{3}{4}$
Hamburgh.	Rix dollar, specie, . . .		4	$7\frac{1}{2}$
	Florin, or Guilder, . . .		1	$8\frac{1}{2}$
Portugal.	New Crusade, 1802, . .		2	4
Russia.	Ruble of Alexandria, 1805, .		3	3
Spain.	Dollar of late coinage, . .		4	$3\frac{3}{4}$
U. States.	Dollar, 1802, . . .		4	$3\frac{1}{4}$
India.	Sicca Rupee, (company's coinage)		2	$0\frac{1}{2}$
	Arcot Rupee, latest coinage, .		1	$11\frac{1}{2}$

The above value is estimated from the essays of Mr. Bingley, assayer of the English Mint, and of Mons. Bonneville, essayeur du Commerce, at Paris.

PROPORTION OF THE ENGLISH POUND AVOIRDUPOIS, TO OTHER WEIGHTS.

		lbs.	
100 lbs.	Avoirdupois, are equal to Amsterdam weight, ...	91	80
"	Antwerp, ...	96	75
"	Copenhagen, ...	90	61
"	Dantzic, ...	103	07
"	France, pois de marc, ...	92	64
"	Riga, ...	108	46
"	Rome, ...	133	69
"	Russia, ...	110	86
"	Scotland, pounds Dutch weight, . .	92	11
"	Spain, Castilian weight, . . .	98	40
"	Vienna, ...	81	—
"	Warsaw, new Polish weight, . .	112	25

MEASURES OF LENGTH.

	Feet.	
100 English feet are equal to Amsterdam,	107	62
" to Berne, ...	103	98
" to France, Pieds de roi, ...	93	89
" to Rhine-land, common measure, in Germany and Holland, ...	97	17
" to Rome, ...	103	45
" to Spain, ...	107	91
" to Sweden, ...	102	66

The following are the number of acres, corresponding to ten English acres.

LAND MEASURE.

England, roods, ...	40	
perches, ...	1600	
France, old system, arpents, ...	11	84
new system, ares, ...	404	68
hectacres, ...	4	05
Ireland, acres, ...	6	17
Scotland, acres, ...	7	87
Saxony, acres, ...	7	84
Spain, fanegadas, ...	10	47
arrauzadas, ...	8	80

ROAD MEASURES.

100 English miles are equal to Irish, . .	57	93
" to Russia versts, ...	150	81
" German long, ...	17	38
" do. short, ...	25	66
" geographical, ...	21	72
" French astronomical leagues, . .	36	21
" " marine do. . . .	28	97
" " land measure 2000 toises each,	41	28

The English mile is equal to $1\frac{3}{4}$ versts.

PAPERS ON MANUFACTURES.

ON THE MANUFACTURE OF WOOLLEN CLOTH.

The following paper was written by a regular Manufacturer, and the processes described are those in actual use in the west of England, where the finest Cloths that receive the London stamp are made.

Spanish wool is bought by the manufacturer ready sorted: to make the first quality cloth, he purchases two qualities, the 1st and 2d.—When the bags are brought to the mill for use, they are cut open, and the bagging carefully taken off. A woman is employed to pick off the straws, lint, &c. The wool is then taken to the scouring house, where a ley had been prepared, composed of one part stale urine and two parts water: or, three parts water, one part urine, and a small quantity of American pot-ash: the last is more generally used, from an idea, that the pot-ash neutralizes the urinary acid. When the ley is heated to such a degree, that the hand if immersed in it, can be retained in it but for a short time, a small quantity of wool is taken from the heap, thrown into the ley, and well worked, until the yolk and grease are removed; it is then thrown on railings placed across the furnace, and resting on the curb, so as to be kept warm by the steam. A second portion is then thrown into the boiler and worked as before: by the time this is done, the first lot will be sufficiently drained for washing; it is then taken to the swilling basket, small quantities washed at a time, and the instant it is immersed, the workman moves it backwards and forwards to open the wool, and that the stream may pass through it to carry off the yolk and grease. When well washed, the wool is thrown into baskets with handles, and left to drain till next day; it is then carried to the nearest pasture field, and spread on pieces of sail-cloth, previously laid down for the purpose, and then left until sufficiently dry: should the day be fair, the wool is taken in before it is quite dry, should it be cloudy it cannot be made too dry.

REMARKS ON THE ABOVE PROCESS.

In the United States, when wool is purchased in the fleece, it is necessary to have it well sorted: bagging the wool is attended with considerable loss; the bags, by being tumbled about on the wharves, streets, ware-houses, and mill-seats, gather a large quantity of dust, which, passing through the bagging, soils the wool and adds considerably to the weight; the lint from the bagging mixes with the wool: and to separate it after finishing costs two pence sterling per yard, and if not separated will shew white upon the surface.

In scouring, the greasy matter, attached to the wool, chemically combines with the alkali of the ley, forming a saponaceous compound, which mixes with the water in washing, and thereby becomes detached. The natural oil, exuded from the sheep, would be preferable to artificial oil, could the yolk be separated, leaving the oil in the wool, for the yolk makes the wool work hard, and leaves so much filth in the cards of the machines as to fill them up and prevent them from working: the separating the one without the other appears impracticable; therefore scouring must be considered absolutely necessary.

Urine, when used, should be stale, that it may have become decomposed, for when fresh it abounds with acid; that, which is voided by persons living high and drinking much, is not so good as that of those who live low; for this reason one bucket full, collected from a prison or poor-house, is considered as worth two from families living well.*

A ley, when made, may be used for fourteen or fifteen days, by adding a sufficiency of the mixture to keep up the original quantity; when new, it does not scour so well: it is usual to let the old liquor settle, to skim off the filth, and throw one third of it into a cask to mix with a fresh making.

Wool, when scoured, should be used as soon as possible; for if two lots are made up, one soon after scouring, and the other

* Compare Archives, Vol. 1. pp. 99—100. *Editor.*

three months afterwards, the first will be worth from 10 to 15 per cent. more than the other.

Fine wool should never be scoured after coarse, but coarse may follow fine without any inconvenience or injury.

REMARKS BY THE EDITOR.

In order to have a cloth of uniform appearance and quality, besides the foregoing directions, the following should be carefully attended to.

The wool intended for a piece of cloth, must not only be of the same degree of fineness, the same length, but it should be taken from animals of the same sex and age. Thus the wool of rams should not be mixed with that of ewes, nor that of wethers or lambs with either. Pulled wool and shorn wool should also be kept apart; and above all, the wool of diseased and healthy animals should be worked up separately on account of the influence which a state of health has upon the capacity of the wool for taking colour. On this subject, M. Roard, director of the Dyeing establishment in the Imperial manufactories in France, is very decisive; he says, "all his experiments prove that the affinity for the colouring matter in wool, varies according to the species, and to the healthy or diseased state of the animal, and that the wool of healthy merinos is always more highly coloured than the wool from diseased animals."*

On the scouring of wool, M. Roard adds, first, it is dangerous to raise the temperature of the fluid above 60° (of Reaumur) or to leave the wool in it longer than a quarter of an hour, for it is liable to be very soon injured in boiling water.

2. Wools scoured at two operations can never be rendered completely white. This effect seems to proceed from a change of state in the greasy colouring matter, which by becoming more highly oxydated loses its solubility.

3. Wools constantly assume in copper vessels, solid colours,

* Annales de Chimie, No. 158. This paper is translated in Tilloch's Phil. Mag., but incorrectly. The errors have been corrected.

more or less deep, which even at the lowest degree of colouration, prevent them from taking the first shades of a tint. This effect is obviated by the use of tin vessels, the oxide of which cannot alter the whiteness of the wool during steeping.

4. The opinion of M. Roard on the superior whiteness of cloth made from wool spun in the natural yolk or grease, over that made of wool previously scoured, has already been given ;* but it must be received with some qualification. In some merinos, the extrication of this natural perspirable fluid is so abundant, as to colour the wool and to adhere like wax, and if carded without scouring, it will certainly clog the cards ;† but if the animals have been well washed in clear water, and afterwards kept for a few days in a clean pasture before shearing, it will be found, that the superabundant yolk will generally be washed out, and yet enough of the natural oil left in to make it card easily. The wool of the common sheep of the United States and of England, have but little of this grease or yolk, and therefore an interval of several days between washing the sheep and shearing them are indispensable to permit it to rise.

It may be remarked too, that at the wool fair held in Ireland in July, 1811, it is stated by Lord Sheffield, in his annual *expose* of the state of the wool trade, that " the manufacturers were satisfied with the manner in which the wool was made up, though merely river washed upon the sheep's back."‡

5. Full grown wool, shorn from the live animal, makes the best

* Archives, vol. 1, p. 96.

† The grease (*suint* in French) or yolk, is a fatty unctuous substance, with a very strong smell, which is supplied in the sheep by sweat; when dissolved in water, and filtered to disengage it from the earthy and animal matters, it is of a yellow brown colour, more or less inclined to red, and composed according to M. Vauquelin, of a soap, with a basis of potash, combined with carbonic, acetic, and muriatic acids. Filtration likewise separates a white matter floating on the surface of the grease, and which in scouring does not combine with the alkalies: it appears to be of the nature of suet: it becomes liquid at a low temperature, and takes fire very easily." M. Roard.

‡ Literary Panorama, vol. x. p. 1144. London.

cloth; that which is pulled from the skins of slaughtered sheep answers very well for flannel, hosiery, &c.; but as such wool in general is not full grown, the fibres are weak, and the roots preventing it from fulling properly, the cloth made from it is harsh.

6. The wools of sheep from different countries, ought not to mixed in the same web, on account of their different capacities to take dyes. This fact was discovered in the following manner. "Having ascertained," says M. Roard, "that the causes which influenced our operations could not arise from the manipulation of the dyer, we complained to our wool merchant of the bad quality of his goods. He then acknowledged that he mixed the wools of Flanders with those of Holland, as customary in the trade; and that though all the dyers had constantly complained of the same defects, yet as they had neglected to acquaint him with the cause, he had not been able to take such measures as to prevent it in future. These wools have another defect, which it is important to mention; I mean the increase given to them by passing them through buttermilk, and which amounts almost to one-eighth of their weight. They are surcharged with a white dusty matter, which after careful and repeated washing, still furnishes a sufficient quantity of acetous acid to change a great number of results in dyeing."

Dr. Parry says, "wool should be kept in baskets or wooden compartments, rather than in bags, which are liable to be rotted by the yolk. Wool is subject to become damp by absorbing moisture from the atmosphere, and will generally be found to weigh more in the winter, and of course to waste more in scouring than in hot weather, when it is first shorn. To this change may be attributed the common prejudice, that wool grows after having been separated from the animal. If it be re-examined, after a continuance of hot and dry weather, it will be reduced by evaporation to its original weight." Dr. Parry adds,

"Wool certainly appears to become somewhat coarser by lying very long in the yolk, which according to Vauquelin, may arise from some incipient decomposition. I know, however,

that it may be so kept two or three years without the least injury.*

The sorting of wool into various qualities, is of the first importance to insure a handsome piece of cloth. In Archives, vol. I, p. 204, the reader will see the accuracy and minuteness with which the fleece is divided in England. The paper deserves the serious attention of the manufacturer, being written by Mr. Luccock, a professed wool stapler; and although it cannot be supposed, that any one not regularly bred to the business of wool sorting, will be able to divide it so minutely as one of the trade, yet it is proper to impress upon the minds of those unacquainted with the business, the necessity of paying as much attention as possible to the directions given; for by mixing fine and coarse in the same piece, or wool of different denominations, the cloth cannot be dressed handsomely, nor will it wear well, or take the intended colour equally. The dead ends must be clipped off with a pair of scissors or shears,† and then picked and greased in the proportion of one pound of hog's fat, to ten pounds of wool,‡ and thoroughly pulled, opened and mixed, after which it is to be broken on cards, of a degree of fineness proportioned to that of the wool: then divided equally for warp or chain, and filling or woof. That which is intended for warp, must be twisted smaller and closer than that for filling, which may be as slack as possible, provided it be well woven. One person should spin the chain and another the filling, to insure uniformity in the thread, and to prevent the cloth from puckering or cockling when dressed. Keep the wool clean from motes, lint or dust in spinning. The *chain* should be spun with the wheel cross-banded. Many clothiers spin both chain and filling with the cross-band; but when the fililng is spun

* The wool will, nevertheless, look coarser by being kept: as may be determined by keeping a small specimen for a year in paper. Wool which cannot be worked up the season it is shorn, ought not to be washed, as it is not so liable to be destroyed by moths if the grease be left in. *Editor.*

† If the wool to be used, be that of dead sheep, after the skins are washed and dried, they may be spread upon a table, and clipped with sheep shears.

‡ Inferior sweet oil is used in Europe. Benne oil would probably answer.

without crossing the band, it makes the softest and prettiest cloth. It is well known that wool spins best in warm weather. When spun, the thread is said to be *warped*, and must then be stiffened with size, made either of glue, or by boiling shreds of parchment or of skins or sinews of animals in water. When dry it is to be given to the weavers, who mount it on the loom." The warp being on the floor, the weavers, who are two to each loom, one on each side, tread at the same time alternately on the same tredle; that is, first on the right step, and then on the left, which raises and lowers the threads of the warp equally: between which they throw transversely, the shuttle from the one to the other: and each time that the shuttle is thrown, and a thread of the woof is inserted within the warp, they strike it conjointly with the same frame in which is fastened the comb or reed, between whose teeth the threads of the warp are passed, repeating the stroke as often as is necessary: in some cloths no less than twelve or thirteen times: six with the warp open, and seven shut. It is taken off the loom by unrolling it from the beam, on which it had been rolled in proportion as it was woven, and then given to be cleared of knots, ends of threads, straws, &c. which is done by little iron nippers."*

It is requisite to beat up the cloth equally, or it will cockle; and to trim with shears as it is woven; for if all knots are not cut off before the cloth is filled, the clothier sometimes leaves holes by picking them out.

Old harnessing should be avoided in weaving cloth, as they abound in lint or floss.

Fulling.—The fuller then commences his operations, by scouring the cloth with urine, or with that peculiar earth called *Fuller's earth*, well cleaned and steeped in water, put along with the cloth in the trough in which it is filled. The cloth being again cleared from the earth or urine, by washing it in water, is returned to the former hands, to have the lesser filth, small straws, and almost imperceptible knots taken off as before: then it is re-

* Millard's Pocket Cyclopædia, p. 416. London, 1811.

turned to the fuller to be beaten and filled with hot water in which soap has been dissolved. For fine cloths, this soap should be of the finest and whitest kind.

Smoothing.—"After fulling, it is taken out to be smoothed; that is, to be pulled by the lists lengthways, to take out the wrinkles and creases occasioned by the forces of the mallets or pestles falling on the cloth when in the troughs. The smoothing is repeated until the fulling is finished, and the cloth brought to its proper breadth: after which it is washed in clear water to free it from the soap, and given wet to the carders, to raise the nap, on the right side, with the thistle [teazel] with which they give it two rubs or courses, the first against the grain, the second with the grain." *Millard's Cyclop.*

For the purpose of raising the nap on cloths, hand-cards are at present universally used in Pennsylvania; but they answer the end very imperfectly, and increase the expense of manufacture very much, when compared with the operation of the GIG MILL, an implement which should be introduced as soon as possible into every cloth manufactory. This gig mill consists of teazel (*Dipsacus Fullonum*) fixed in numerous small frames, which are again fixed in a cylindrical frame of about two feet diameter and composed of slats or ribs having groves cut through their whole length, to receive the frames containing the teazels. The cloth passes over the gig mill sufficiently close to raise the nap, and winds round a cylinder below. The mill is turned by water or steam.

From the testimony given by the cloth manufacturers to a committee of the British house of commons, it appears that the following advantages are derived from the use of the gig mill.*

* The history of the gig mill is somewhat curious. It has been used in Gloucestershire from a very early date of the woollen manufacture, and yet is prohibited by two statutes passed in the reign of Edward IVth. This, however, is not the only instance in which European governments have interfered with the manufacturers, to the injury of the nation and of the individual. In other counties, as in that of Wilts, it was first introduced about five years ago, previously to which the same work was either done by hand, or sent to Gloucestershire to be dressed. Gig mills are now in general use.

"It does not stretch out the cloth to more than one-twentieth part of that which was its length, when it came out of the loom: and the cloth is not found to shrink more from the use of this machine, than if it were dressed with the hand only; it is moreover rendered softer, mellower, and more uniform, than that which is dressed with the hand." The use of this machine requires attention and practice to derive all the benefit it is capable of yielding. It is partially in use in the states of New York and New England, and as the teazle seed is very easily procured, the plant should be cultivated by all concerned in the manufactory of cloth.*

The spring shuttle so greatly diminishes the labour of weaving, that it ought to be introduced in all woollen, cloth, linen, or cotton manufactories.

Shearing.—"The cloth being dried after this preparation [on tenter hooks] the shearman gives it the first cut or shearing. This done, the carders, after wetting it, give it as many more rubs, or courses, with the teazel, as the quality of the cloth requires; always observing to begin against the hair, and to end with it: and to begin with a smoother thistle, proceeding still to a sharper one, as far as the sixth degree. The shearman and carder repeat these operations, till the nap is well ranged on the surface of the cloth from one end to the other."

The *shearing of cloth* is an operation upon which much of the good appearance of the fabric depends. In the United States this has hitherto always been performed by hand, by means of the old fashioned shears; but within a short time several shearing machines have been invented in the states of New York and New England, to go by water or steam; and all have their advocates. It is believed the number amounts to eight. The common hand shears have also been set to go by water, and so fixed as to be thrown out of geer when they have come to the end of the table on which the cloth they are shearing, is stretched. The Editor saw these at work in two manufactories during the last

* In the present No. a paper is given on the cultivation of this plant.

autumn, and can bear witness to the excellence of their performance.

Shears and all machinery, go so much more regularly by means of the *steady* power of water or steam, that manual labour ought never to be employed, where either of those powers and the workmen necessary for their erection can be obtained.

Dyeing.—" After the process of dyeing the cloth, it is washed in water, and the shearman lays the nap with a brush on a table, and hangs it on the tenters, where it is stretched both in length and breadth enough to smooth it, and brought to its proper dimensions, without straining it too much; observing to brush it afresh the way of the nap, while yet a little moist on the tenter."

Pressing and Glazing.—" When quite dry, the cloth is taken from the tenter, and brushed again on the table to finish the laying the nap: it is then folded, and laid *cold* under a press, to make it smooth and even and to give it a little gloss. The gloss is given by laying a leaf of vellum, or cap-paper, in each plait of the piece, and over the whole, a square piece of wood, on which, by means of a lever, the screw of a press is brought down with the degree of force judged necessary. The cloth is now fit for sale."*

It appears from a work by Mr. Bakewell,† that in England " cloth is now finished without that hard shining surface which was given to it a few years since by *hot pressing*, which prevented the softness of the pile from being felt. By the present mode of *cold pressing*, the softness of the pile becomes immediately perceptible to the touch, and is considered as one of the most distinguished and essential qualities of good cloth."

No reason can be given for the original introduction of the absurd practice of hot pressing cloths, except that of catching the eye, by the shining appearance given to them, and give a temporary smooth and agreeable feel. But *good wine needs no bush*,

* Millard's Pocket Cyclopædia.

† Observations upon the influence of soil and climate on wool. London, 1808.

and hence in France, a shining appearance has never been deemed necessary to the sale of cloth; and those who have had the satisfaction to wear a fine French broad cloth, invariably prefer them not only on account of the soft, mellow feel they communicate to the hand, but also by reason of their superior durability. A French cloth looks well to the last, and bears hard usage well, but it is universally known that the British cloths, (with probably some few exceptions) soon wear rough, and do not last near so long as the former. Indeed the good taste of the people of the United States has within a few years, taught them to despise the vulgar gloss of an English broad cloth, and hence almost constantly order it to be spunged previously to being made up. But as it is probable, that with a certain class of people, shining coarse cloths will be preferred, the hot press will be necessary for their gratification.*

The weather too has an influence upon the feel of the cloth. Dr. Parry says, he was informed by the manufacturers of the West of England, that in very hot weather, they cannot make a piece of cloth from Spanish wool so good in appearance, by nearly two shillings a yard, as it would be if made in a cooler, moister season. In Yorkshire it is well known. Mr. Bakewell says, that cloth dried in hot weather, or in an over heated store, will not finish so well, or feel so soft, as that which is dried by a more moderate degree of warmth, and in a moister state of the atmosphere.

ON THE PROPERTIES OF BLUED STEEL.

By Mr. Wm. Nicholson.†

IN making springs of steel the metal is drawn or hammered out and fashioned to the desired figure. It is then hardened by ignition to a low red heat and plunging it in water, which ren-

* The most powerful press, (considering the power) the Editor ever saw, is the invention of Israel Nicholls, of Otsego county, New York. See the head "Useful Arts," in this No.

† Philos. Journal, vol. 11, p. 63.

ders it quite brittle. And lastly, it is tempered either by blazing or blueing. The operation of blazing consists in smearing the article with oil, or fat, and then heating it till thick vapours are emitted and burn off with a blaze. I suppose this temperature to be nearly the same as that of boiling mercury, which is generally reckoned to be at the 600° of Fahrenheit, though, for reasons I shall in future mention, I think this point requires to be examined. The operation of blueing consists in first brightening the surface of the steel, and then exposing it to the regulated heat of a plate of metal or a charcoal fire, or the flame of a lamp, until the surface acquires a blue colour by oxidation. The remarkable facts which I have here to present to the notice of philosophers are, that Mr. Stodart assures me that he has found the spring or elasticity of the steel to be greatly impaired by taking off the blue with sand paper or otherwise; and, what is still more striking, that it may be restored again by the blueing process without any previous hardening or other additional treatment.

Mr. Hardy, who is meritoriously known as a skilful artist, assured me some time ago that the saw-makers first harden their plates in the usual manner, in which state they are more or less contorted or warped, and are brittle;—that they then blaze them: which process deprives them of all springiness, so that they may be bended and hammered quite flat, which is a delicate part of the art of saw making;—and that they blue them on an hot iron which renders them stiff and springy without altering the flatness of their surface. Mr. H. finds that soft unhardened steel may be rendered more elastic by blueing, and that hard steel is more expansible by heat than soft.

It is very difficult to reason or even to conjecture upon these facts. They certainly deserve to be verified by a direct process of examination.

COPPER PLATES FOR ENGRAVING.

The following method is now followed in London for preparing Copper plates.*

A SHEET of copper must be chosen as free as possible from flaws, and of a somewhat greater thickness than the finished plate is intended to be: it is then to be scraped all over with a *scraper*, in shape something like the head of a spear, and fixed in a handle long enough to go under the arm, the other hand holding the tool near the cutting part. When it has been perfectly freed from the outward crust, scales, or rust, it must be carefully examined to see if there are any holes or flaws in it; if there are (which is almost always the case), they must be scooped out by a tool called a *scooper*. This being done, it is next to be well and regularly hammered all over on an anvil, of a considerable degree of convexity, in order to harden it; and afterwards on a broad and nearly flat anvil, to flatten and planish it. After this has been performed, it is to be cut to the size wanted, and the edges a little chamfered or bevilled, and is then to be stoned, that is, rubbed all over with a fast cutting, but not very coarse, grit stone, care being taken to use a great quantity of water, to float off the particles mutually abraded from the copper and stone. When it is judged that all the marks of the scooper and hammer are rubbed out, a stone of a fine grit is to be used in the same manner, and after this a third.

The two first-mentioned stones are sold at the ironmongers in London, under the name of "Carpenters' stone;" the best kind are brought principally from the coal fields in the neighbourhood of Bilston in Staffordshire. The stone last used is called "Water of Ayre stone," and brought from Dumfriesshire. All the three kinds contain a considerable quantity of argil in their composition. Lately, a very fine grained argillaceous grit, brought from the neighbourhood of Sheffield, has been used instead of the Bilston stone.

After the operation of stoning has been performed, the plate is

* Rees' Cyclopædia.

to be "coaled." This is done by rubbing it first with charcoal of birch-wood, or alder, and water, and then with charcoal of willow: the latter gives the finer polish, particularly if oil instead of water be used. Sometimes the plates are finished by burnishing, but this is not now often done.

The charcoal is not prepared by the copper-plate makers, but is procured from the dealers in that article by the workmen, who take a plate of copper, and by trial discover which pieces are fit for their purpose.

METHOD OF GIVING THE GRAIN AND HARDNESS OF STEEL TO COPPER.

By B. G. Sage.*

MARGRAFF and Pelletier have published their researches on the union of phosphorus with different metallic substances: the French chemist has improved this process, and it was by repeating and varrying his experiments that I discovered that the surest and speediest means of phosphorizing copper was to take the metal under the metallic form, to fuse it with two parts of animal glass, and a twelfth of charcoal powder; but it is essential that the copper should present a great deal of surface,—an advantage obtained by taking shavings of that metal, which are placed in strata with animal glass mixed with charcoal powder. I expose the crucible to a fire sufficiently strong to fuse the animal glass. There is then formed phosphorus, the greater part of which burns, while another combines with the copper, in which it remains incarcerated till no more is disengaged, though kept in fusion for twenty minutes under the animal glass which has not been decomposed.

When the crucible has cooled, and is broken, the phosphorated copper is found in the form of a gray brilliant button under the

* From the *Journal de Physique*, Messidor, an. 12. Translated for Nicholson's Journal, Vol. 20.

glass, which has passed to the state of red enamel. On being weighed, it is found that by this operation its weight has been increased a twelfth.

If the phosphorized copper, when fused, falls on a plate of polished iron, it extends itself over it in the form of plates differently figured, which exhibit the play of colours of a pigeon's neck.

The phosphorized copper is much more fusible than common copper: it may often be fused under charcoal powder without losing any of its properties.

The same phosphorized copper, when exposed a long time under the muffle, separates only with great difficulty from the phosphorus.

The copper thus combined with phosphorus acquires the hardness of steel, of which it has the grain and the colour: like it, it is susceptible of the finest polish; it can be easily turned; it does not become altered in the air. I have kept buttons of polished phosphorized copper in my laboratory for fifteen years, without their experiencing any alteration. The copper emits no smell when rubbed. Were it ductile, it would be of the greatest utility, since no fat bodies seem to have any hold of it.

In the phosphorization of copper there is only a part of the animal glass decomposed, because a quantity of charcoal necessary to phosphorize the whole acid has not been employed: but it is necessary that this should be the case in order that the vitreous scoria should be sufficiently fluid for the phosphorus to be disengaged and to collect itself readily.

The dark red enamel which is formed in this experiment may be employed with advantage for porcelain and enamels, as this red does not alter in the fire.

Copper can combine with phosphorus only in the dry way. If a cylinder of phosphorus be put into a solution of nitrate of copper diluted with four or five thousand parts of water, copper under the metallic form will be found at the end of eight days crystallized and ductile, forming a case to the cylinder of phosphorus.

DESCRIPTION OF THE COPPER-MINES IN THE PARIS MOUNTAIN, IN THE ISLAND OF ANGLESEA.

From a tour through England and Wales, in 1791.

THESE Copper-Works appear like a vast quarry dug in the mountain. They are totally unlike the usual appearance of copper-mines, and seem to resemble them only in affording ore. Instead of finding a narrow vein of copper, you are presented with one vast rock of ore. They separate it from the quarry with gunpowder, a process attended with some degree of danger to the miners, who frequently receive damage from the fragments that fly about. Whenever they set fire to their train, they shout to their companions, as a signal for them to keep off. The agent of the works placed us in a situation which he thought secure; but, after the explosion, a great deal of the shattered fragments came tumbling about our ears. It is conveyed either in carts, or in buckets, to the surface, and rises most beautifully rich in its appearance; although, I believe, its value is not estimated by its beauty. After the ore is dug, the first process here is to calcine it in a furnace, by which means the sulphur is expelled, and they can afterwards separate the waste from the pure ore, making thus a great saving in the carriage to the different smelting house. Nor is this the only advantage they derive from the calcination of the ore: when fire is applied to it in the furnace, it begins to burn, and will continue in that state from six to seven, eight, or nine months. During all this time, vast quantities of sulphur exhale from the ore. This is conveyed in vapour through conductors to a large oblong receiver with a concave roof, where, becoming condensed, it adheres to the sides of the receiver, or falls in a fine powder to the bottom. This is what the chemists call *sublimation*, and that which is obtained in this operation of the ore they call flowers of sulphur. It is then melted in a large copper, and poured off into moulds, when it becomes stone brimstone. Such vast quantities of sulphur are contained in the ore dug here, that more brimstone is made from the works of this company, than is necessary for the consumption of England.

Being almost stifled with the sulphureous air of the Paris Mountain, we were obliged to leave it, and brought with us several specimens of this beautiful copper, which, from its colour, is called the peacock ore; but there is one circumstance I have omitted to mention, and which I think the greatest curiosity of the Paris Mountain. A natural spring of water flows from the bed of ore, so impregnated with copper, that it will discharge it upon the smallest approach of iron. It is conveyed from pumps through wooden troughs, and we perceived a thin coat of copper incrusting even the heads of the nails that it flowed over. There is also a large quantity of water brought from the quarry, which is more strongly impregnated with the copper, and which assumes a beautiful green colour. This they convey with care to several large cisterns, formed for the purpose, which are first filled with plates of cast iron.

The instant the iron comes in contact with the water, the copper is precipitated. For the acid in the water, which before dissolved the copper, now preferring the iron, discharges the copper and dissolves the iron. Thus the iron takes the place of the copper as fast as the former dissolves and the latter precipitates. And it is this phænomenon which has led many into numberless errors with regard to the transmutation of metals. Finding that the iron vanished and copper appeared, they inferred that the iron was changed into copper, whereas it is merely a change of place, the iron assuming the situation of the copper, and resigning its own to that metal.*

The truth of this may easily be perceived, by applying the

* The iron is turned every day to shake off the incrustation of copper formed upon it, and this is continued till the iron is dissolved. The workmen then drain off the water, and rake together the ore in the form of mud, which, when it is become, by drying, of the consistence of paste, they bake in ovens constructed for the purpose, and export it with the ore to Swansea and Liverpool. One ton immersed in this manner, produces near two tons of copper mud, each of which when melted, will produce 1600 wt. of copper. This sells at a much higher price than the copper, which is fluxed from the ore. This method of attaining copper by means of iron, had been long practised in Germany. Bingley's Tour in North Wales. Vol. 1. p. 274. London, 1800. *Editor.*

Prussian alkali to the water that has discharged its copper, when a precipitation of iron will instantly take place.

A great quantity of copper is thus gained from the water in the mine, which is by much the richest and most valuable of any they have.

This amazing resource for copper was discovered by a poor woman digging peat. She found something more than common in the appearance of the earth, and communicated the intelligence to her husband. The news soon spread; it proved to be an almost inexhaustible bed of ore. We naturally enquired what reward the poor family had, that first brought such a fund of riches to the island. They all assured us, that no reward was ever given. An Englishman can hardly credit this, especially when he is told, that one noble earl alone derives an income of thirty thousand pounds yearly from these works.

A PARTICULAR ACCOUNT OF THE EXTRAORDINARY COLLECTION OF SALTPETRE IN FRANCE.

THE following extract, from Mr. Prieur's Account of the extraordinary collection of Saltpetre, which took place in the second and third year of the French Republic, gives a wonderful proof of the energetic impulse which pervaded that nation, when in a manner unprepared to resist the formidable force in league against it.

"One still recollects with astonishment and admiration, the enthusiastic spirit of every Frenchman, at a time, when their country was in the greatest danger; and the prodigious efforts which resulted from it, towards furnishing an enormous quantity of arms of every kind, and of gunpowder, which the nation was much in want of—the almost instantaneous erection of numberless building, in all parts of the Republic, for making and repairing all sorts of polished arms, muskets, and cannons of every bore, both for the land and sea service; as well as the incredible quantity of ammunition, utensils, machines, and other necessaries for the con-

sumption and use of more than 900,000 men, stationed at one time on the frontiers, independent of the national guards in the interior:* in a word, so great a toil, as may be easily conceived, put in action an incredible number of workmen.

"It was found necessary to employ therein, those men whose labour was of an analogous kind; that is to say, men of different vocations in the rough work of wood and metals; and even such as were acquainted with the more refined and finished parts. It was necessary also, in a manner to make apprentices of those workmen, who had been taken from their usual occupations, and to put them under intelligent and skilful masters; these also were to be instructed by artists still more experienced, who would throw a light upon the practical part, rectify, simplify, and entirely change it, in certain cases, by taking advantage of the acquired and accurate knowledge of the first men of the kind: in short, it was necessary, that all should be constantly instructed, moved to action, encouraged, and sustained, by a powerful government, which gave every proof of being devoted to the service of its country, and was endowed with sound judgment and energetic will. But if I may be allowed the expression, it was necessary to give impulse to a whole nation, when the business was brought forward, of extracting every where the saltpetre earth contained in the French soil. This art was, in fact, an object more confined; it was almost generally unknown. Private interest was alarmed at seeing it set on foot; and still more numerous prejudices produced a variety of obstacles. Men could not be persuaded that persons so untaught, and at that time perfect strangers to the business, could all at once engage in it with success: they could not believe that France was so rich in that precious commodity, which was never known to have been extracted in sufficient quantity for ordinary use; and of which a

* To give a full idea of the immensity of this fabrication, it will be within bounds to declare, that, in one month, there were delivered from the founderies, 597 brass, and 452 iron cannon, of different bores; and 7000 brass, and 12 or 13,000 iron cannon, were mounted fit for service, in the space of one year.

full supply had only been obtained, by means of what was brought from India.

"In the mean time, at the invitation of the National Convention, proclaimed by a decree of the 14th of *Frimair 2d year*, the citizens gave themselves up to the making of saltpetre. The number of buildings erected in the Republic, on this grand occasion, amounted rapidly to 6000. Necessary instructions were every where distributed by order of government. Erance was divided into large districts, each of which was continually surveyed, by an inspector skilled in arts and sciences. Under each inspector, in every department, was placed a former Director of the National Administration of Saltpetre Works; who appointed in each district, a citizen sufficiently intelligent to preside over the formation of the offices, and to regulate the works: and thus was activity established in every place at once.

On the other hand, a summons was issued for every district to send two robust and intelligent cannoniers to Paris, to receive their instructions from the most skilful persons*; who were to explain to them the art of preparing saltpetre—of refining it, and of making gunpowder; and to some of them, the mode of casting cannon. These pupils were then sent back into the different establishments, to assist in the works according to their capacities. Government kept up an active correspondence with all its agents; it supplied them occasionally with every necessary, and every where made easy the executive part. It was known, that every district could easily furnish a thousand weight of saltpetre every decade, and orders were given for that quantity; places were pointed out where to send it to; the means of conveying it were

* There were sent to Paris, in consequence of this order, about 1,100 men, to whom citizens Guyton, Fourcroy, Dufourny, Bertholet, Carny, Pluvinet, Monge, Hassenfratz, and Perrier, gave instructive lectures, on the fabrication of satpetre and cannon. This course commenced on the first *Ventose, an* 2, and the summary of each lecture was formed into a little work, and printed by order of the Committee of Public Safety. This Committee also gave charge to Citizen Monge, to draw up a complete description of the process for making cannon; in consequence of which, he published a most valuable work upon that subject, in large 4to. with a number of plates.

fixed upon; and frequent accounts were rendered of every operation. In short, so much care produced the desired effects; more than sixteen millions of pounds of rough saltpetre were collected in one year;* and the working of it up, although recalled in the following year, to the laws formerly enacted, still yielded nearly five millions and a half of this saline substance.

"But thus filling the magazines was not sufficient, it was necessary to refine it for making powder; the former mode was too tedious, too embarrassing, in a word, was impracticable, considering the urgent necessity for powder. A new and more advantageous process was proposed by M. Carny, which when properly executed, requires less time, consumes less fuel, disposes the saltpetre to dry more readily, demands less extent of ground and buildings, and consequently occasions less loss of saltpetre.

"In a short time, the refinery of *l'Unité* was built, on the abbey-ground of St. Germain-des-pres, at Paris. Saltpetre flowed there in profusion; and this establishment alone yielded in the refined state, regularly every day near 30,000 lbs.†

Information concerning some of the Silicious productions of the United States that are proper for military purposes.

In a letter from Samuel L. Mitchill, member of Congress, &c. to the Editor.

A FEW days ago, I read in the Commercial Daily Advertiser of Baltimore, an extract of a letter from London, dated November 2d, 1812, which particularly attracted my attention. It stated, that the British ministry, a little before that time, had, in addition to other restrictions and prohibitions on American

* The summing up of the decadary accounts, addressed officially to government announce a production of 16,754,039 lbs. of saltpetre, from the 14th *Frimaire, year* 2, to the same date *year* 3.

† It was in part burnt, by accident, on the 4th *Fructidor, an* 2. which circumstance did not long interrupt the business; it was renewed at length, although on a less scale than before.

ships, *caused such as had ballasted with "chalk" to discharge the same, lest some "flint-stones" should be found among it.*

It is generally known that *chalk* constitutes the basis or principal matter of the soil in several counties of England. This is the case in Middlesex, where the metropolis stands, and on both sides of the Thames; and it is as well understood, that the chalky strata contain great numbers of *silicious bodies*.

CHALK and SILEX being there very plentiful and cheap, are purchased at that grand resort of vessels, either separately or together, for ballast. In some places to which they are carried, they serve the further purpose of merchandize. In the United States, for example, chalk is sold for a variety of economical purposes; and it is affirmed, that the silicious stones bring a good price at the Canton market; being bought by the Chinese to help their manufacture of porcelaine.

Some of the masses of silex bedded in the chalky strata of England, are employed in the preparation of gun-flints. Those manufactured articles have heretofore been largely imported thence into North America. They have been procured upon such easy terms, that our people have too much overlooked their domestic treasures of silex. The British government, naturally enough supposes, that nature has denied it to us; and in refusing to let it be transported as ballast, they conclude they shall deprive us of a material so essential to the effect of fire-arms.

To remove all uneasiness upon a subject of so much importance, measures were adopted by the commander of the forces at New York, early in August last, to explore the banks of the river Musconetung, in the state of New Jersey; and to bring to the view of those whom it concerned, the silicious region thereabout.

Since the report upon that undertaking was made, other information has been brought to me, which I take great satisfaction in stating to you.

Pennsylvania contains silex. Robert Whitehill, Esq. one of her representatives in Congress, showed to me and to many others, a nodule of true silex, of a cancavo-convex fracture, of a

blackish colour, and of a greasy feel. When broken, it was semi-transparent at the edges. It seemed as if it could be made into excellent flints for muskets; and it was decomposed so far at its surface, as to be covered with a whitish coat. The specimen was found about four miles from Harrisburgh, in Paxton township, Dauphin county; and it is alleged that the article abounds near the same place.

Silex has been discovered in Virginia. William M'Coy, Esq. one of her members in the national legislature, assures me that there is an abundance of a black species, about two miles from the town of Franklin, in Pendleton county; and in various other parts of that vicinity. He says the inhabitants had frequently made flints for their guns, from the crude materials lying over the ground. The natural masses are of different sizes, from one pound to ten or twelve.

A good supply of silex can be furnished by Georgia. My intelligent correspondent, John Le Conte, Esq. of Riceborough, described to me very lately, a parcel of silicious stones, near Briar-creek, on the road from Augusta toward the sea. Some of them were pure silex. Others approached to agate and chalcedony. On what is called the *old road*, there appears to have been, as this accurate observer declares, an Indian manufactory of weapons. Many of them appear to have been fractured or chipped off, evidently for the purpose of making those arrow-heads or spear-heads, which are now almost the only remaining vestiges of the aboriginal arts, in that region. It is to be observed, that this very tract of country contains the famous oyster-shell, or lime-stone ridge.* Among the modifications of silex, this gentleman mentioned one sort, the outside of which was calcareous, abounding with small shells, that still retained their characteristic shapes.

It is also stated upon authority highly respectable, that at a place called Mobley's pond, in Burke county, and at the distance of four miles from Savannah river, there is a great quantity of

* See Bartram's Travels for an account of this singular mass. *Editor.*

rock-flint, of fine quality. The stratum is reported to contain, both the *opake* or *black* silex, and the *semi-transparent* or *oily*. General Twiggs is quoted as a witness of those things, and of the additional fact, that he, often during the revolution war, obtained supplies of flints from this place.

These might seem to be enough: yet I will point your attention to certain other localities, in relation to silex.

The honourable Charles Tait, of the Senate of the United States, brought to Washington in the beginning of November last, a fragment of a silicious stone, taken by himself from the village of Abbeville, in South Carolina. It was a coarse chart, with a straight and angular fracture. Its outside had been altered by exposure and was converted to a yellowish crust. It yielded sparks readily, and contained crystals apparently of amphibole or schoerl. Though this sample did not seem fit for gun-flints, it may nevertheless aid investigation, whenever the silex of our country shall be the object.

Several years ago, I was informed by a military officer of experience and observation, that silex abounded in the state of New York. My subsequent opportunities of visiting the region referred to, have confirmed that gentleman's information. Silex is stratified with the lime-stone, not only at Black rock, on the east side of Niagara river, a short distance below the outlet of Lake Erie, but for many miles to the eastward, on both sides of the post-road. The lumps, when detached from their association with the calcareous carbonate, strike fire admirably with steel. They are very common. The specimens, however, which I have examined, are too brittle for gun-flints; and besides, when they break they do not assume the proper fracture and figure. But, as these remarks apply only to those which lie near the surface, the indications are strong enough to encourage a belief, that by a wider and deeper survey, the genuine fire-stone for musketry can be discovered. At any rate, it is important that they whose business it is to provide for the wants of an army, should have the Seneka fields and the Buffaloe plains in contemplation.

I have the firmest persuasion that a more intimate acquaint-

ance with the mineralogy of the land, will bring many more beds of silex to public notice.

Now, with so much knowledge, and with the sense of duty commanding an improvement of internal resources, the American people may rely upon themselves for this necessary article, and prove to the world, that they need not be dependent upon a foreign land even for a gun-flint.

Allow me to express the peculiar satisfaction I feel in communicating these things to you.

SAMUEL L. MITCHILL.

JAMES MEASE, M. D., &c. &c.

Washington, Jan. 20, 1813.

[The late George Clymer, Esq. of Philadelphia, informed the Editor last summer, that General Gates told him, *Mount Independence*, opposite Ticonderoga, abounded with flint.]

ON SAFFLOWER.*

THIS plant, *(Carthamus, or Bastard Saffron,)* the flower of which is employed in dyeing and colouring, is cultivated in Spain and in many parts of the Levant,† from which it is chiefly imported.

This dyeing material contains two colouring matters, a yellow and red, the former of these alone is soluble in water and is comparatively of little value, the latter is soluble in alkalies and precipitated thence by several acids and forms a beautiful rose-red pigment. This is partly used for silk dyeing, but the great consumption of it is in the *rouge* so celebrated as a cosmetic, and of which it forms the essential ingredient.

To prepare the carthamus for this purpose it is necessary first to extract the yellow portion, which is done by tying the plant in

* From Aikin's Chemical Dictionary.

† Berthollet Elemens de la Teinture. Beckmann Comment. Gotting. vol. 8 and 4. Dufour. An. Chem. Tom. 48.

a linen bag, and then washing it incessantly with water, using much squeezing and rincing till the water passes off colourless. The residue in the linen bag now consists of the fibrous part of the plant and of the valued red fecula, which last however is in very small quantity. This is extracted by digesting the washed carthamus in a solution of carbonat of soda, (without applying artificial heat, which would impair the colour,) and this gives an orange yellow alkaline solution, which on saturation with acids turns red, and gradually deposits a beautiful red fecula, which is the pigment in question. Lemon juice is the acid preferred. But as the colour of this red fecula is extremely intense it will bear dilutions, which is done chiefly by rubbing it with finely powdered talc, in different proportions.*

Alcohol will also dissolve the red part of carthamus; and after the yellow portion has been extracted by water, a fine red tincture is made by digesting the residue in alcohol.

On account of the high price of carthamus it is seldom if ever employed except for giving a finishing gloss to dyed silks, and for the preparation of rouge. Alkalies of every kind immediately alter the colour to an orange yellow, again restorable by acids.

* The fineness of the talc, and the proportion of it mixed with the carthamus, occasion the difference between the cheaper and dearer kinds of rouge. —Imison's Elements Vol. 2. p. 433. *Editor.*

DUTCH PROCESS FOR MAKING THE BLUE CALLED TURNSOL.*

LICHEN, Archil, or in case this cannot be obtained, the great moss of the oak is dried, cleaned, and pulverised in a mill resembling an oil mill, and then sifted through a brass wire sieve, the interstices of which do not exceed one millimetre in width (1-250th of an inch). The sifted powder is then thrown into a trough and mixed with an alkali called Vedas, which is nothing else but the cendres gravellies (pearl-ash) in powder. The proportion is one part by weight of the alkali, to two parts of the pulverised vegetable. This mixture is moistened with a small quantity of human urine: the urine of other animals does not contain a sufficient quantity of ammonia. The mixture ferments and is kept moist by successive additions of urine. As soon as the materials have become red, they are transferred into another trough, where they are again moistened with urine and stirred to renew the fermentation. Some days afterwards the paste acquires a blue colour, in which state it is carefully mixed with one-third of excellent pot-ash well powdered; and with this new mixture certain trays are filled, which are one metre (39½ inches) deep, and eight decimetres (31½ inches) wide. When the fermentation, which takes place for the third time, has given the paste a considerable deep blue colour, chalk or powdered marble is added, and the whole is well and perfectly mixed. This last addition is made, not to improve the quality of the blue, but to add to its weight. It is merely an affair of profit. The blue thus prepared is put into iron moulds 32 centimetres long and 22 square at the end (1¼ inch by $\frac{8}{10}$ of an inch). The moulded pieces are then placed upon deal planks in well aired lofts to dry: after which they are packed in casks for sale.

The Hollanders made a secret of this process: and in order to

* From the Journal du Commerce—Translated for Nicholson's Journal, vol 2d, 4to.

mislead they have published that the blue was made with rags coloured by the plant turnsol: whence it has obtained its denomination.*

A New Table of the Quantities of Acid in Sulphuric Acid of different Densities, constructed for the Use of Manufacturers; being the result of experiments made with the strongest Sulphuric Acid of Commerce. The specific Gravities taken at the Temperature of 60°. By SAMUEL PARKES, *F. L. S.*

From Tilloch's Phil. Mag. Sept. 1812.

SIR,

HAVING been applied to by several persons in different parts of the kingdom, for instructions respecting a mode of ascertaining the quantity of acid in diluted sulphuric acid, I invariably referred them to Dr. Kirwan's Table, which was published in the year 1793, in the fourth volume of the Transactions of the Royal Irish Academy. This however always proved unsatisfactory, inasmuch as few manufacturers understood how to accomodate that table to the common oil of vitriol, or make it applicable to any practical purpose. This has arisen from the circumstance of Dr. Kirwan having taken sulphuric acid, as it exists in sulphate of potass, instead of the strongest oil of vitriol, for his standard of real acid. Having, in my own business, found the inconvenience of this, I several years ago formed a table for my private use, from the sulphuric acid of commerce, by diluting that acid with several successive portions of water; a table which I have ever since employed with great advantage. But as this table was formed at a temperature above the mean temperature of the atmosphere, and its range was too confined to be of use in every instance, I resolved to undertake the formation of a new one that would be more generally useful, and that should descend by regular gradation, down to the lowest point of dilution that

* English writers have used this denomination, but the dry salters, or dealers in drugs, distinguish these pestils by the name of litmus.

any consumer of sulphuric acid would be likely to require.* Having now, at no small expence of time and labour, completed this Table, I shall be obliged if you will have the goodness to insert it in the next Philosophical Magazine, as I conceive that it will be acceptable and useful to many individuals in various branches of trade and manufacture.

In making this table, I might have taken *purified* sulphuric acid, *i. e.* such as had undergone a second distillation; but as this is an article which is never employed but for philosophical purposes, I thought it better to make use of the common acid, and to take as good a sample of that kind as I could possibly procure. I have therefore chosen some of my own manufacture, made in the usual way, and concentrated, as is common in large manufactories, by steaming it in a boiler of lead, and finishing it in a retort of glass. When I began the experiment, the atmosphere of the room was at 60°†, and the acid was of the specific gravity of 1·8494, which, at this temperature, is as strong as it is ever sold.

In order to form the annexed Table, I proceeded as follows;

I first accurately weighed ten thousand grs. of this acid into a stoppered bottle of glass, and then added to it 100 grains of pure water.‡ When the mixture was become cool, after having been sufficiently agitated, the specific gravity of it was taken, and the result forms the first line of the Table. In this way I continued to dilute the acid with successive portions of water, taking care to let it rest a sufficient time between each addition of the water, that a complete union between the acid and the water might take

* The first line of the Table shows the specific gravity of a mixture of one part water and 100 parts of strong sulphuric acid. The latter, the specific gravity of one part of sulphuric acid mixed with 100 parts of water.

† For the difference which is occasioned in the specific gravity of sulphuric acid by change of temperature, consult Nicholson's Journal, quarto, vol. iii. page 211.

‡ In diluting sulphuric acid, it is usual, and safer, to add the acid by degrees to the water, and not the water to the acid; but with this very small quantity of water, such caution was not necessary.

place; having found by experiment that a mixture of sulphuric acid and water, even after it has become cold, requires several hours for it to arrive at the maximum of condensation. I took also the precaution of keeping it in stoppered bottles, that it might not imbibe water from the atmosphere, and frequently agitated it during each interval. And, in order to attain as great accuracy as possible, I procured a gravity bottle larger than usual, one that holds nearly ten ounces of water, and with a stem so small that at the part to which the fluid rises when properly filled, a single drop of the liquor will occasion a rise of nearly one sixteenth of an inch.

The balance which I made use of in these experiments, is so delicate that it will turn with the 20th part of a grain; and as the acids will erode the common scale-dishes, if dropt upon them, and endanger the accuracy of a result, I have long been in the habit of using those made with Wedgewood's ware, and such were employed in making this Table. Those parts of the Table which have a star opposite to them, were made by actual experiment—the intermediate ones were the results of calculation.

Since I concluded these experiments it occurred to me, that it might be useful to some manufacturers to know the quantity of acid per cent. in diluted acid of any given strength: I have therefore calculated the quantity in each, and annexed it. The column of *ounces* and *drachms* is added for the use of those who are accustomed to this mode of reckoning, and also for those who are not conversant with the usual method of stating specific gravities; and is calculated on the supposition of the wine pint holding exactly sixteen ounces avoirdupois of pure water.*

* It is a convenient way of measuring, to have a glass bottle with a narrow neck holding rather more than a pint of water, with a mark on the stem exactly at the place to which the water ascends when it contains exactly 16 ounces avoirdupois of that fluid. It was formerly understood that the standard wine pint was the exact measure of 16 ounces of pure water; but some experiments made in the year 1688, before the Lord Mayor and the Board of Excise, decided, that the sealed wine gallon of Guildhall contains only 224 cubic inches, though by the fifth of Queen Ann, chap. vii. § 7, it is called 231 inches. This decision makes the wine pint to hold only ·970 of an avoirdupois pound of wa-

The sulphuric acid which is consumed in these kingdoms amounts I believe to upwards of three thousand tons annually: the greater part of which is used in a state of dilution. For the purposes of dissolving iron or zinc, it should be diluted with at least five or six times its weight of water. Sulphuric acid is consumed in large quantities by bleachers, for making the oxymuriate of lime, and these people always use it in a state of dilution. The calico printers also expend large sums in the purchase of this acid, which they use in various states of dilution, for making what they call sours.

To these, and other manufacturers, this Table will be of use, not only in assisting them in the formation of acid of any given strength, but it will enable them at any time to ascertain whether their servants have observed due care in making the different preparations; which is a matter of great moment—for it often happens, that for want of this the printer and manufacturer suffer great loss, and the goods sustain an irreparable injury.

I need scarcely add that the oil of vitriol-makers themselves, may also derive great benefit from attending to this Table.

I am, sir, yours, &c.

SAMUEL PARKES.

Goswell-street Chemical Works,
London, Sept. 2, 1812.

ter; but as it is generally thought right, for all common purposes still to consider it of the capacity of 16 ounces avoirdupois, I have taken it at that in this instance.

A Table of the Specific Gravities of Sulphuric Acid, when diluted with different Portions of Water, at the Temperature 60°.

	Drachms of Water.	Specific Gravity.	Weight of the Wine Pint. Oz.	Drms.	Acid per cent.
100 Drachms	* 1	1·8484	29	$9\frac{1}{4}$	99·009
Sulp. Acid.	* 2	1·8465	29	$8\frac{3}{4}$	98·039
Sp. Grav.	* 3	1·8445	29	$8\frac{1}{4}$	97·087
1·8494,	* 4	1.8416	29	$7\frac{1}{2}$	96·153
Or, 29 oz.	* 5	1·8387	29	$6\frac{3}{4}$	95·238
9 1-2 Drachms,	6	1·8358	29	6	94·339
the Weight, Avoirdupois, of	* 7	1·8319	29	5	93·457
the Wine Pint.	8	1·8270	29	$3\frac{3}{4}$	92·509
	9	1·8222	29	$2\frac{1}{2}$	91·743
	*10	1·8163	29	1	90·909
	11	1·8104	28	$15\frac{1}{2}$	90·090
	12	1·8046	28	14	89·285
	13	1·7988	28	$12\frac{1}{2}$	88·495
	14	1·7929	28	11	87·719
	*15	1·7880	28	$9\frac{3}{4}$	86·956
	16	1·7821	28	8	86·206
	17	1·7744	28	$6\frac{1}{4}$	85·470
	18	1·7666	28	$4\frac{1}{4}$	84·745
	19	1·7588	28	$2\frac{1}{4}$	84·033
	20	1·7510	28	$0\frac{1}{4}$	83·333
	*21	1·7431	27	$14\frac{1}{4}$	82·644
	22	1·7353	27	$12\frac{1}{4}$	81·967
	23	1·7275	27	$10\frac{1}{4}$	81·300
	24	1·7207	27	$8\frac{1}{2}$	80·645
	25	1·7138	27	$6\frac{3}{4}$	80·000
	26	1·7070	27	5	79.365
	*27	1·7002	27	$3\frac{1}{4}$	78·740
	28	1·6933	27	$1\frac{1}{2}$	78·125
	29	1·6865	26	$15\frac{3}{4}$	77·519
	30	1·6796	26	14	76·923
	31	1·6728	26	$12\frac{1}{4}$	76.335
	32	1.6660	26	$10\frac{1}{2}$	75·757
	*33	1·6582	26	$8\frac{1}{2}$	75·187
	34	1·6523	26	7	74·626
	35	1·6464	26	$5\frac{1}{2}$	74·074
	36	1·6406	26	4	73·529
	37	1·6348	26	$2\frac{1}{2}$	72·992

	Drachms of Water.	Specific Gravity.	Weight of the Wine Pint. Oz.	Drms.	Acid per cent.
100 Drachms Sulp. Acid. Sp. Grav. 1·8494, Or, 29 oz. 9 1-2 Drachms, the Weight, Avoirdupois, of the Wine Pint.	38	1·6289	26	1	72·463
	39	1·6230	25	15½	71·942
	*40	1·6171	25	14	71·428
	41	1·6113	25	12½	70·921
	42	1·6054	25	11	70·422
	43	1·5995	25	9½	69·930
	44	1·5937	25	8	69·444
	*45	1·5879	25	6½	68·965
	46	1·5820	25	5	68·493
	47	1·5761	25	3½	68·027
	48	1·5703	25	2	67·567
	49	1·5645	25	0½	67·114
	50	1·5585	24	15	66·666
	51	1·5526	24	13½	66·225
	52	1.5478	24	12¼	65·789
	53	1·5429	24	11	65·359
	*54	1·5390	24	10	64·935
	55	1·5351	24	9	64·516
	56	1·5312	24	8	64·102
	57	1·5273	24	7	63·694
	58	1·5234	24	6	63.291
	59	1·5195	24	5	62·893
	60	1·5156	24	4	62·500
	61	1·5117	24	3	62·111
	*62	1·5078	24	2	61·728
	63	1·5039	24	1	61·349
	64	1·5000	24	0	60·975
	65	1·4960	23	15	60·606
	66	1·4921	23	14	60·240
	67	1·4882	23	13	59·880
	68	1·4843	23	12	59·523
	69	1·4804	23	11	59·171
	*70	1·4765	23	10	58·823
	71	1·4726	23	9	58·481
	72	1·4687	23	8	58·139
	73	1·4648	23	7	57·803
	74	1·4609	23	6	57·471
	75	1·4570	23	5	57·142
	76	1·4531	23	4	56·818
	77	1·4502	23	3¼	56·497
	*78	1·4473	23	2½	56·179

	Drachms of Water.	Specific Gravity.	Weight of the Wine Pint. Oz.	Drms.	Acid per cent.
100 Drachms	79	1·4433	23	1½	55·865
Sulp. Acid.	80	1·4395	23	0½	55·555
Sp. Grav.	81	1·4365	22	15¾	55·248
1·8494,	82	1·4336	22	15	54·945
Or, 29 oz.	83	1·4306	22	14¼	54·644
9 1-2 Drachms,	84	1·4276	22	13½	54·347
the Weight,	85	1·4257	22	12¾	54·054
Avoirdupois, of	*86	1·4218	22	12	53·763
the Wine Pint.	87	1·4189	22	11¼	53·475
	88	1·4160	22	10½	53·191
	89	1·4130	22	9¾	52·910
	90	1·4101	22	9	52·631
	91	1·4072	22	8½	52·356
	92	1·4042	22	7½	52·083
	93	1·4013	22	6¾	51·813
	*94	1·3984	22	6	51·546
	95	1·3955	22	5¼	51·282
	96	1·3926	22	4½	51·020
	97	1·3906	22	4	50·761
	98	1·3886	22	3½	50·505
	99	1·3867	22	3	50·256
	*100	1·3848	22	2½	50·000
	105	1·3730	21	15½	48·780
	*110	1·3632	21	13	47·619
	115	1·3535	21	10½	46·511
	*120	1·3437	21	8	45·454
	125	1·3359	21	6	44·444
	*130	1·3281	21	4	43·478
	135	1·3203	21	2	42·553
	*140	1·3125	21	0	41·666
	145	1·3056	20	14¼	40·816
	*150	1.2988	20	12½	40·000
	155	1·2919	20	10¾	39·215
	*160	1·2851	20	9	38·461
	165	1·2783	20	7¼	37·735
	170	1·2724	20	5¾	37·037
	175	1·2676	20	4½	36·363
	*180	1·2627	20	3¼	35·714
	185	1·2568	20	1¾	35·087
	190	1·2520	20	0½	34·482
	195	1·2470	19	15¼	33·898

	Drachms of Water.	Specific Gravity.	Weight of the Wine Pint. Oz.	Drms.	Acid per cent.
100 Drachms Sulp. Acid. Sp. Grav. 1·8494,	*200	1·2421	19	14	33·333
	210	1·2343	19	12	32·258
	*220	1·2265	19	10	31·250
	230	1·2187	19	8	30·303
Or, 29 oz. 9 1-2 Drachms, the Weight, Avoirdupois, of the Wine Pint.	*240	1·2129	19	$6\frac{1}{2}$	29·411
	250	1·2060	19	$4\frac{3}{4}$	28·571
	*260	1·1992	19	3	27·777
	270	1·1933	19	$1\frac{1}{2}$	27·027
	*280	1·1875	19	0	26·315
	290	1·1825	18	$14\frac{3}{4}$	25·641
	*300	1·1776	18	$13\frac{1}{2}$	25·000
	310	1·1728	18	$12\frac{1}{4}$	24·390
	320	1·1679	18	11	23·809
	330	1·1630	18	$9\frac{3}{4}$	23·255
	*340	1.1582	18	$8\frac{1}{2}$	22·727
	350	1·1552	18	$7\frac{3}{4}$	22·222
	360	1·1523	18	7	21·739
	370	1·1494	18	$6\frac{1}{4}$	21·276
	*380	1·1464	18	$5\frac{1}{2}$	20·833
	390	1·1426	18	$4\frac{1}{2}$	20·408
	400	1·1338	18	$2\frac{1}{4}$	20·000
	*420	1·1328	18	2	19·230
	440	1·1279	18	$0\frac{3}{4}$	18·518
	*460	1·1240	17	$15\frac{3}{4}$	17·857
	480	1·1181	17	$14\frac{1}{4}$	17·241
	*500	1·1132	17	13	16·666
	*550	1·1054	17	11	15·384
	*600	1·0966	17	$8\frac{3}{4}$	14·285
	*650	1·0898	17	7	13·333
	*700	1·0839	17	$5\frac{1}{2}$	12·500
	*750	1·0781	17	4	11·764
	*800	1·0732	17	$2\frac{3}{4}$	11·111
	*850	1·0693	17	$1\frac{3}{4}$	10·526
	*900	1·0664	17	1	10·000
	*950	1·0625	17	0	9·523
	*1000	1·0602	16	$15\frac{1}{2}$	9·090
	*1100	1·0546	16	14	8·333
	*1200	1·0507	16	13	7·692
	*1300	1·0488	16	$12\frac{1}{2}$	7·142
	*1400	1·0458	16	$11\frac{3}{4}$	6·666
	*1500	1·0429	16	11	6·250

	Drachms of Water.	Specific Gravity.	Weight of the Wine Pint.		Acid per cent.
			Oz.	Drms.	
100 Drachms	1600	1·0390	16	10	5·882
Sulp. Acid.	1700	1·0370	16	9 1/2	5·555
Sp. Grav.	*1800	1·0351	16	9	5·263
1·8494,	1900	1·0337	16	8 5/8	5·000
Or, 29 oz.	*2000	1·0322	16	8 1/4	4·761
9 1-2 Drachms,	*2250	1·0283	16	7 1/4	4·255
the Weight,	*2500	1·0254	16	6 1/2	3·846
Avoirdupois,	*2750	1·0234	16	6	3·508
of the Wine	*3000	1·0214	16	5 1/2	3·225
Pint.	*3500	1·0185	16	4 3/4	2·777
	*4000	1·0166	16	4 1/4	2·439
	*4500	1·0146	16	3 3/4	2·173
	*5000	1·0127	16	3 1/4	1·960
	5500	1·0117	16	3	1·785
	*6000	1·0107	16	2 3/4	1·639
	6500	1·0102	16	2 5/8	1·515
	*7000	1·0098	16	2 1/2	1·408
	7500	1·0093	16	2 3/8	1·315
	*8000	1·0088	16	2 1/2	1·234
	8500	1·0083	16	2 1/8	1·162
	*9000	1·0078	16	2	1·098
	9500	1·0073	16	1 7/8	1·041
	*10000	1·0068	16	1 3/4	0·990

PAPERS ON

RURAL AND DOMESTIC ECONOMY.

ON HANGING AND SECURING GRINDSTONES.

Specification of the Patent granted to JOHN SLATER, of Birmingham, in the County of Warwick, Coach-spring-maker; for an improvement in hanging and securing Grind-stones from breaking in the middle or centre.

Dated February 12, 1810.

FIRST, I cause each grindstone to be hung through its centre upon a spindle, in the customary manner, tight wedging excepted; and then I place on each side of the grindstone a flat piece of wood, or washer, or other substance of a soft or yielding nature, which must extend in a circle from the spindle hole in the grindstone to any degree or part of its diameter, as may be found most convenient, to form a bed, or equal bearing, against or upon the wood or washer so described. I place on each side of the grindstone a flat ring or rings, of iron or other metal, wrought or cast, about half an inch thick, more or less: and the diameter of the circle of each ring or rings must be about twenty-four inches more or less, as may be most conveniently adapted to the magnitude of the grindstone; and to which ring or rings I add a pair of strong gripes or bracing plates, with screws, made of iron or any other metal; each of which pair of gripes or bracing plates is to be a strong flat circular plate, and correspond in diameter with the ring or rings described above. And each griper or bracing plate must have a hole in its centre, of a proper size and figure to admit and receive the spindle of the grindstone. And also, as near as convenient to and round the circular outward edges of each griper or bracing plate, I cause holes to be made, at small distances, of a proper size and form to receive or admit screwed nuts or burrs fitted and screwed to them so as to hold and admit of strong screw pins or bolts, which must be made to screw pointedly, or in a direct manner, towards the before-described ring or rings and grindstone. The strong gripes or bracing plates, with

strong screws, may be made occasionally with or without the nuts or burrs, as their necessity depends upon the gripes or bracing plates being made of cast or wrought iron. The gripes or bracing plates being thus made, I then place them upon the rings, one on each side of the grindstone, the spindle of the said grindstone passing through them all, which are then to be secured completely tight and firm to their places, by cottets through, or screws fixed to, the spindle of the grindstone. On the outside of the whole griping or bracing apparatus I then firmly screw the screws or bolts in the gripes or bracing plates on or against the rings or washers, so as to press, gripe, or brace, and hold the grindstone between the apparatus on each and both its sides. And for the better elucidation of my said apparatus, I have caused drawings to be made in the margin of these presents.

In witness whereof, &c.

REFERENCE TO THE PLATE.—PLATE 1, FIG. 2.

A, a view of the grindstone and apparatus complete, as at work. B B, the flat piece of wood or washer for the bearing. C C, the two flat rings. D D, represents the strong gripes or bracing plates, with screws. E, the cotters, to secure and hold fast the apparatus to both sides the grindstone. F, the strong screws, pins or bolts in the gripes or bracing plates, to screw pointedly on and against the rings C C.

METHODS OF PREVENTING DAMPNESS OF WALLS.

THE usual way is to work blocks of wood in the walls, as they are carrying up, and to nail battens to them for the purpose of lathing on; thus leaving an interval of two or three inches between the bricks or stone, and the inside of the laths. On the authority of an excellent builder in Philadelphia, this practice was formerly objected to, by reason of his having known instances of walls thus prepared, being thrown several inches out of plumb, in consequence of the expansion of the blocks; and in

the room of them, it was recommended to place battens from one and a half to two inches thick, at proper distances against the walls and the height of the room, securing them by stay nails driven between the joints, and to lay the laths upon those battens.* Another builder has, however, found no injury from the use of blocks, and therefore approves of the method; but those he used were made of the *heart* of *pitch pine.* If pitch pine cannot be procured, and blocks be used, they ought to be well seasoned, either by being kept in the shade, or by baking in an oven, in order to expel all moisture.

In case of a house being already built, as thousands are, even in damp and exposed situations, without either of the foregoing precautions, the following application may be tried, to keep out moisture. From an opinion of its merits, the Society of Arts in London, granted the inventor of it a premium of ten guineas in 1806:—

"Boil two quarts of tar, with two ounces of kitchen grease, for a quarter of an hour in an iron pot. Add some of this tar to a mixture of slaked lime, and powdered glass, which have passed through a flour sieve, and been completely dried over the fire in an iron pot, in the proportion of two parts of lime and one of glass, till the mixture becomes of the consistence of thin plaster. The cement must be used immediately after being mixed, and therefore it is proper not to mix more of it than will coat one square foot of wall, since it quickly becomes too hard for use, and care must be taken to prevent any moisture from mixing with the cement." For a wall merely damp, a coating one-eighth of an inch thick will be sufficient, but if the wall is wet, there must be a second coat. Plaster made of lime, hair, and plaster Paris, may afterwards be laid on as a cement. The cement above described will unite the parts of Portland stone or marble, so as to make them as durable as they were prior to a fracture.

* Dom. Ency. article House.

TO TAKE STAINS OUT OF TANNED LEATHER.

From the Monthly Mag. London, vol. 22.

PUT half a pint of water in a bottle, and add one fourth of a pint of sulphuric or nitrous acid; afterwards add half an ounce of salts of lemon. When the heat caused by this mixture is subsided, add half a pint of skimmed milk; shake the whole occasionally for three or four days, and the liquor will be fit for use. To apply this mixture, cleanse the surface of the article, with a brush and soft water, next scrape on a little bath brick, or white free-sand, and add a little of the above liquor, and with a brush scower it well, repeating this process till the whole has been gone over: then with a clean sponge and water wash off what remains of the brick: leave the leather to dry gradually, and it will be of a light new colour. If it is wished to be darker, brush it with a hard brush a little before it is dry, and it will be of a rich brown tinge.

ON SPONTANEOUS COMBUSTION.

SOME of the causes that lead to this serious accident have already been stated, and others referred to:* but as they cannot be too often laid before the public, particulary when they take place, from the operation of new causes, the following are here inserted.

The East India company's ship Earl Camden was set on fire in the following way, according to the report of the committee appointed to investigate the cause of the loss:

" From the evidence before us, it appears that the fire broke out on the larboard side of the gun room: that linseed oil and spirits of turpentine, were kept in the gun room, after that part of the ship had been stowed with cotton: that these combustible articles were deposited on the transoms and sills of the gun room ports; that the gunner and his mate were in the habit of repairing to them, to replenish their paint buckets, while they were en-

* Archives, vol. 3d, p. 167.

gaged in the task of painting the ship: that the light to guide them proceeded from a glass bulls-eye in each gun room port, and that the gunner always went and returned on the larboard side, on which the fire originated."

"From these facts we are led to the following inferences. First that oil had accidentally spilled in replenishing the paint buckets, and that with the inclination of the ship, it had run forward among the cotton. Secondly, that in conveying the replenished paint buckets along the larboard side of the gun room, paint had been accidentally spilled on the bales. Lastly, that the oil, absorbed by the gunny of the bales, produced the spontaneous ignition: and that upon the communication of the current of air, from the gun room scuttle, and the scuttles cut in the deck, it burst forth into irresistible conflagration."*

"A mercantile house at Hull, shipped in 1802, some bales of yarn packed in coarse linen wrappers; during the passage of the vessel to Gainsborough, a cask of linseed oil was staved and ran among the bales of yarn; being thus spoilt, it was returned to the merchants who sent it from Hull, it was unpacked, and the wrappers washed in soap and water and old urine three times, then returned to the warehouseman, who exposed those wrappers three days to dry. On the Saturday evening about six o'clock, he took them down, threw them loosely together, and placed them then not perfectly dry, immediately behind the warehouse door. Early the next morning, a smoke was discovered issuing from the door and windows of the warehouse, and on the door being opened, these wrappers were found in a flame, particularly round the outward edges as they lay, and the floor although of four inch plank, was nearly burnt through. There was no access to this place, except through the partner's house, and he locked and unlocked that entrance on the Saturday night and Sunday following:" the fire must therefore have been spontaneous. Part of one of the wrappers not consumed, smelt strongly of the linseed oil, and doubtless there was a portion remaining in the cloth after the washing.†

* Panorama, Vol. 5, London.

† Wonders of Nature, by Delafond, London 1803.

A NEW AND EXPEDITIOUS MODE OF BUDDING.

By Thomas Andrew Knight, Esq. F. R. S.*

PARKINSON, in his Paradisus Londoniensis, which was published in 1629, has observed, that the nurserymen of his days had been so long in the practice of substituting one variety of fruit for another, that the habit of doing so was almost become hereditary amongst them: were we to judge from the modern practice, in some public nurseries, we might suspect the possessors of them to be the offspring of intermarriages between the descendants of those alluded to by Parkinson. He has, however, mentioned his "very good friend, Master John Tradescant," and "Master John Miller," as exceptions; and similar exceptions are, I believe, to be found in modern days. It must however be admitted, that, wherever the character of the leaf does not expose the errour of the grafter, as in the different varieties of the peach and nectarine, mistakes will sometimes occur; and therefore a mode of changing the variety, or of introducing a branch of another variety, with great expedition, may possibly be acceptable to many readers of the Horticultural Transactions.

The luxuriant shoots of peach and nectarine trees are generally barren; but the lateral shoots emitted, in the same season, by them, are often productive of fruit, particularly if treated in the manner recommended by me in the Horticultural Transactions of 1808. In the experiments I have there described, the bearing wood was afforded by the natural buds of the luxuriant shoots; but I thought it probable, that such might as readily be afforded by the inserted buds of another variety, under appropriate management. I therefore, as early in the month of June, of the year 1808, as the luxuriant shoots of my peach trees were grown sufficiently firm to permit the operation, inserted buds of other varieties into them, employing two distinct ligatures to hold the buds in their places. One ligature was first placed above the bud inserted; and upon the transverse section through the bark: the

* Transactions of the Hort. Soc., London, Vol. i. p. 194.

other, which had no further office than that of securing the bud, was applied in the usual way. As soon as the buds (which never fail under the preceding circumstances) had attached themselves, the ligatures last applied were taken off: but the others were suffered to remain. The passage of the sap upwards was in consequence much obstructed, and the inserted buds began to vegetate strongly in July: and when these had afforded shoots about four inches long, the remaining ligatures were taken off, to permit the excess of sap to pass on; and the young shoots were nailed to the wall. Being there properly exposed to light, their wood ripened well, and afforded blossoms in the succeeding spring: this would, I do not doubt, have afforded fruit; but that, leaving my residence at Elton, I removed my trees; and the whole of their blossoms, in the last spring, proved, in consequence, equally abortive.

GOOSEBERRY WINE.

Communicated for the Archives of Useful Knowledge, by a Lady.*

DISSOLVE three pounds of white sugar in four quarts of water, boil it a quarter of an hour, skim it well, and let it stand till it is almost cold; then take four gallons of full ripe gooseberries, bruise them in a mortar, and put them into your vessel; then pour in the liquor; let it stand two days, stirring it every four hours; steep half an ounce of isinglass chipped fine in a quart of brandy two days; strain the wine through a flannel bag into a cask; then beat the isinglass and brandy in a mortar with the whites of five eggs; whisk them together half an hour†, put it in the wine, and beat them all together; close up the cask, and put clay over the cork; let it stand six months; then bottle it off for use; put in each bottle a small lump of sugar, and two jar raisins. This is a very rich wine, and when it has been kept in the bottles two or three years will drink like champagne.

* The same to whom the Editor is indebted for the recipe to make Orange Mamelade and French Ratifia, pp. 165—6.

† For this purpose clean birch rods, or corn broom may be used.

ON THE ECONOMY DERIVED FROM INSURING PROPERTY FROM LOSS BY FIRE.

This advice is intended principally for people of slender circumstances and beginners on small means, with a view to prevent the necessity of future collections from the public to remunerate such losses.

THERE are several public offices in Philadelphia, where moveable or personal property of every description may be insured at so easy a rate as to be within the means of most people who possess any property, to avail themselves of the opportunity of being secure against loss by fire.

Say a mechanic possessing household furniture worth	$300	
Tools and materials used in the business,	200	
		——500

The charge for insuring this sum, for one year, if in a brick building, will be $1 50 cents.

1000 dollars value in furniture, tools, and materials, $3.

A widow keeping a boarding house or a small shop, and having furniture or goods worth $1000, may be secured for one year for $3.

A widow or single woman, being an under tenant, occupying one or more rooms with furniture worth 200 dollars, may be secured for 60 cents.

And so in proportion for larger or smaller sums.

Perpetual insurance may even be made at the "*American Insurance Office, Philadelphia*," at the rate of 2½ or 3 per cent. on the sum insured.

Are there any in town or country who possess health and a knowledge of any employment, that cannot, in the course of the year, spare as much as either of the sums here stated, to secure themselves against the calamity of fire? The premium for the insurance of a thousand dollars is only equal to one cent per day; and if any privation were necessary to produce such a saving, it would be amply compensated by the reflection, that it would place them above the necessity of looking for relief from public bounty.

If it should be said that there are widows and infirm people

that cannot spare the sum required, as a premium to secure that little property, in such a case it may be answered, let some one of their friends or relatives undertake to do it for them. A trifling sum advanced for such a purpose, would often turn out to be a greater act of friendship than ten times the sum to be given them in other ways.

Insurance from loss by fire produces many advantages; it often saves the party insured from ruin, without producing any inconvenience in remunerating: it exempts the mind in a great measure from that extreme agitation and fear which seizes it on every alarm of fire, and leaves it more tranquil to estimate the degree of real danger, thereby placing it in a better capacity to secure both life and property. The collections often made, prove the benevolence of the citizens generally; but the frequent calls made on them, may weary this disposition. If insurance were more in practice, the fund would not only be abundantly ample to make good all losses, but admit also of the present premiums being reduced. The door of security is open to all; if neglected, complaints ought not hereafter to be made. Was a public contribution to be attempted to remunerate an adventurer who had lost his little all at sea, it would probably be resisted under a general charge of neglect against the party in not having made insurance. Will not the same charge apply with equal force to those who chuse to take their own risk by land, when similar means of security are open to them?

The omission of insurance on personal property, in many instances, is probably more owing to ignorance of the opportunity there is to do it, than to a want of prudential consideration. To do away this obstacle it would seem adviseable for the officers to give every degree of publicity and facility to invite to it; and every individual who is acquainted with its advantages and the mode of effecting it, cannot do a more useful or friendly act than to advise all, within his sphere of intercourse to adopt it.

The advice to insure houses, applies with peculiar force to farmers, who in general neglect to provide for accidents by fire, and in consequence often suffer greatly: loosing in one night, the fruits of many years labour.

PAPERS ON AGRICULTURE.

COMPARATIVE EXPERIMENTS ON THE CULTURE AND APPLICATION OF KOHL RABI, DRUM-HEADED CABBAGE, AND SWEDISH TURNIPS.

Communicated by Mr. JOHN SADDINGTON, of Finchley*.

SIR,

BEING actuated by the most patriotic motives, I beg the favour of you to lay the following communication before the Society of Arts, together with the plants herewith sent. I will endeavour to give you an account, with as much brevity as is in my power to render myself intelligible, of the nature of the soil, the mode of cropping, and the produce thereof. The plot of land being about two acres and a half, and lying on a dead flat, I obtained leave in 1805 to underdrain and break up the same, the grass being sour and useless.

I cut two main drains, forty-two inches deep, gradually rising at top to twenty-eight inches, to give a sufficient fall, with sixteen branches, twenty-four inches deep, rising to sixteen inches, terminating at top like the letter Y: the drains were wooded with elm, and laid with my own hands; this work was done in February. The soil is a loam, with clay and gravel under. On the 20th of March I sowed three bushels and a half of oats per acre, which produced thirty-nine bushels per acre, weighing forty-one pounds per bushel. The straw was used, as it was threshed, for litter to stalled oxen. The 28th of September seeded with winter tares, four bushels of seed per acre. Ate them off in May with sheep. Two fallow ploughings were giving in June and August. About two hundred sheep were brought in at nights by way of fold. The 11th of October sowed three bushels of Thanet wheat per acre. Brined and limed in March, twice fed down with sheep. Produce, twenty-nine bushels per acre, weighing fifty-nine pounds per bushel, and very near three loads and a half of

* Trans. of the Society of Arts, vol. XXVII, p. 75.

straw per acre. The stubble was mowed and cleared off, and the land got ready for turnips. Three pounds of seed were sown the last week in August, when the plants were just making their appearance. Two quarters of gypsum were sown by hand to prevent the fly, which had the desired effect.

This proved a very valuable crop: having two hundred ewes which gave suck, it was a great acquisition to their milk. This induced me to try three experiments last spring with kohl rabi, or purple turnip cabbage, drum-headed cabbage, and Swedish turnips.

With due respect I beg to recommend to the Society kohl rabi, as a prolific and nutritious plant for the feed of sheep and neat cattle; and green food may be produced by this means from October until May. To ensure a succession of keep, seed should be sown in March, April, and May. The plant bulbs above the ground: the leaf is much like that of beet; it will stand in defiance to the severest frost; and as a proof thereof, I have cut with my knife several of the plants through the crown two inches deep, and they have stood three months afterwards in a sound state; some of them are here produced. The plants may be transplanted like those of cabbage; many of those transplanted at eighteen inches apart, I have found to weigh ten and eleven pounds a piece.—I must now beg leave to introduce my method of cultivation, with the average weight of the crop.

On the 14th of May, I sowed four ounces of seed broad-cast, and transplanted about forty-six poles therefrom, on the 18th of June, at twelve inches apart each way. The weight of a square pole is seven hundred and thirty-two pounds, taking each plant to average three pounds. The beauty and regularity of this crop in my idea overbalanced the trouble of transplanting.

I likewise sowed upon a bed in the garden, the second week in March, eight ounces of drum-headed cabbage. The fly and slug were very destructive to the plants. I transplanted them the second week in June, upon ridges thirty-six inches apart, the land being dunged at the rate of twelve loads per acre. Some of the cabbages weighed thirty pounds. I think the average about twelve pounds each, or twenty-five tons eighteen hundred sixty-

four pounds per acre. The caterpillar was very destructive. I have picked off in a morning as many as would fill a quart pot. Although the kohl rabi was planted near to the cabbage, I never saw a catterpillar upon any of the plants.

In the middle of June, I sowed the remainder of the field with Swedish turnips, but lost two thirds of this crop by the fly. One of the best of the Swedish turnips is here produced, in order to shew the great superiority of the kohl rabi, as there is not that waste in being eaten upon the ground, as it bulbs above, and the Swedish turnip in the ground. When the sheep have eaten the turnip level with the ground, and scooped out the inside, the remainder serves as a reservoir for the dirt and filth. The produce of this field has been sufficient for nine score of suckling ewes with rowen for five months. I sent to market, at Christmas last, house lambs fattened with milk only, which weighed eleven stone and one pound each, alive, at eleven weeks old. Should the Society consider these observations worthy of notice, I shall feel myself happy in hearing from you.

I am, Sir, very respectfully, your obedient servant,

JOHN SADDINGTON.

ON THE CULTIVATION OF MADDER.

The paper by Mr. Arbuthnot, p. 279, on the cultivation of this important dyeing root, although very excellent, as being the result of a long and successful practice, yet only referred to its propagation by means of offsets from the roots. But the cultivation of the article in the United States, for some time to come, will be more rapidly extended by means of seeds, and for this reason the following account of the cultivation of the plant in the Levant is given.

*Method of cultivating Madder in Greece.**

IN the Frank commerce, madder is designated under the name of *ali-zari*. The madder of the Levant is only a variety of

* From "A View of the Commerce of Greece," formed after an annual average from 1787 to 1797, by Felix Beaujour, ex-consul in Greece. Paris. Translated by Thomas Hartwell Horne. London, 1800. This is a very amusing and instructive work, and should be in the possession of every merchant.

the French, differing only in having a stalk more slender, leaves more smooth, and in having roots covered with a more tender parenchyme.

This plant grows indifferently in every soil; but it succeeds better in soils substantial and somewhat close, and which are seated on a clayey or sandy bottom. Humid marshy soils agree with it as well as with hemp. This is the reason why the best madder of Bœotia is that gathered on the borders of the lake Copaïs. *Caprena*, or Chœronea, *Scrivo*, or Orchomenus, the muddy Oncheste, and the principal villages on the plain of Thebes, have at this day as fine madder as that which grows on the banks of the Hermus, in the plain of Sardis.

When a person wishes to form a plantation of madder, he makes choice of a level soil, which is prepared as if it were destined for the reception of corn. We set shoots or plants that have proceeded from seed; but, in Greece, the practice of sowing in a nursery is unknown. The pure seed is thrown at random, and in furrows or on beds. The beds are separated from each other by paths or unoccupied borders, which divide the soil symmetrically, and present an agreeable prospect.

I ought to have mentioned, that the Levantines infuse their seed in horse-dung, before they commit it to the earth.

The madder is sown here in Pluviôse* and in Ventôse;† and, as soon as it arrives at the height of three or four feet, it has a bank of earth erected round its root. That operation consists in laying the stalk across the bed, and in covering it with earth, taken from the two lateral, or side paths, and is repeated every year, until the plant has shot forth new stalks: care is also taken every time to take the earth from the contiguous paths, which at length become trenches, while the beds become little banks.

The madder is not gathered here till the fourth or fifth year, which is the reason why the plant has time to enlarge itself, and be laden with fine and numerous roots, in which all the value of the madder consists.

* From January 20 to February 19.

† From February 19 to March 21.

The roots must be picked by hand, and carefully disengaged from the soil with which they are mixed. The practice of washing them, in order to cleanse them, is pernicious; because, the washing of them carries off part of the principal colouring substance.

As soon as the roots have been picked, they are deposited under shelter, and dried in the shade by the sole action of the air. The Greeks think that the rays of the sun would diminish the colouring substance; but this opinion is not probable, since we see, that the red colour of the madder, when applied on stuff, resists, without fading, the united action of the air and sun. Their practice has, in other respects, advantages, of which they have no suspicion. First, the colouring substance does not imbibe, in a free air, those fuliginous particles, which would tarnish it in a stove: secondly, the root diminishes, in drying, only six-sevenths, whereas, in a stove, it is reduced seven-eighths. These advantages are sufficiently real, without seeking any imaginary ones: they are also sufficiently great, and therefore the Greek practice ought to be adopted in all countries where the dryness of the air permits it.

The Levantines will never be persuaded to make use of fresh madder, which would give them an opportunity of saving half the roots, without diminishing their dying properties. But there are some cultivators, who reduce their madder, in drying, only five-sixths of its weight. That reduction is not sufficient: the root thus dried pounds badly, and clots together instead of being pounded. It is known to be sufficiently dry, when, on being rubbed in one's hands, it crumbles to pieces.

An arpent of land, sown with madder, yields, at the end of four years, four thousand okes of fresh roots; which, according to my circulation, must be reduced nearly to six hundred okes,* when they are dried.

* An oke is equal to 3lb. 2oz. English. From the produce of a patch raised by Mr. Salsbury of London, he calculates that an acre would yield fifteen hundred weight of the fresh root. This estimate is made upon the supposition that the seeds are sown in drills, one foot distant from each other. *Editor.*

In the commerce of Rotterdam, two species of madder are distinguished; that in *branches* and that in *clusters;* but, in the commerce of the Levant, all the aly-zari is sold in the *branch*, or, as it is called, in *sortc.* This last mode is subject to a thousand impositions."

The following directions to cultivate madder were given by a native of Smyrna, to Mr. *Jacob C. Otto*, who patriotically brought a quantity of madder seed to Philadelphia, in the year 1811.*

"Madder requires a soil rich and moist. The ground must be first well ploughed. The sowing season is from the middle of March to the middle of April. The first year its appearance resembles grass, and grows to about the height of one foot, and during the arid months of June and July, it dries up. The second year it grows to the height of two feet, and produces a flower, and seed like a pepper corn. In June and July, it dries up, and is cut and used as litter for cattle. The third year it grows three feet in height, and its leaves resemble those of the myrtle. It produces even at this age a flower and seed, and then dries up, and is also used for food and litter for cattle. The fourth year it grows but little higher than the third, and is thought to have attained its full height. After the plant has flowered, dried up and been cut, they take the roots from the earth in the months of July and August. People who are rich, leave them in the ground five, seven, and even ten years. And it is calculated that the root penetrates deeper into the earth every year, and becomes ten per cent. better in quality; the dye

* Mr. Otto put the greater part of the madder seed into the hands of the Editor, who distributed it among those who were most likely to attend to its cultivation. But he has been concerned to find, that none of it vegetated. This confirms the fact stated by Mr. Salisbury, (Trans. Soc. Arts, London, Vol. 25) that madder seed more than one year old will not grow, and it may serve as a guide to those who wish to follow the patriotic example of Mr. Otto, by attempting to send the seed of madder to the United States. It ought to be of the growth of the year in which it is exported, and directions should be given to have it sown immediately on its arrival, if that should not happen to be later than September in the middle states.

Roots should be sent also in earth to insure the introduction of the plant.

being better and stronger, the older the root is. If the root be left in the earth longer than ten years, it runs into wood, which deteriorates rather than improves the quality. When the root is taken from the earth, it must be left to dry about fifteen days in the sun, and freed from the earth adhering to it. The cleaner the root, the clearer and finer will be the dye. The seed of the first and second years is the best for sowing. If the ground be very moist, it is planted in rows, as is usual in Holland."

ON THE CULTIVATION OF LIQUORICE ROOT,

From Martyn's edition of Millar's Gardener's Dictionary.

THERE are four species of *Glycyrrhiza*, viz. 1. the *G. echinata*, or Prickly-headed Liquorice. 2. *G. glabra*, or Common Liquorice. 3. *G. hirsuta*, or Hairy Liquorice. 4. *G. asperrima*, or Rough Liquorice.

It is the 2d species, or *G. glabra*, that is cultivated for its use in medicine. It is a native of the south of Europe, and of China. It has been cultivated since the time of Elizabeth, in England, and is at present largely grown about Pontefract, in Yorkshire. The leaves are composed of four or five pairs of ovate-leaflets, terminated by an odd one: these and the stalks are clammy, and of a dark green. The pods are short, containing two or three seeds. The roots run deep into the ground, and creep to a considerable distance, especially where they stand long unremoved.

It delights in a light sandy soil, which should be three feet deep at least; for the goodness of liquorice depends on the length of the roots: the ground should be well dug and manured the year before the roots are planted, that the dung may be perfectly rotted and mixed with the earth, otherwise it will be apt to stop the roots from running down; and before planting, the ground should be dug three spades deep and laid very light. The sets must be fresh plants taken from the sides or heads of the old roots, each having a good bud or eye, otherwise they are

subject to miscarry: these plants should be about ten inches long, and perfectly sound.

"The best season for planting them is in the beginning or middle of March, which must be done in the following manner, viz. First strain a line across the ground in which you would plant them, then with a long dibble made on purpose, put in the shoot, so that the whole plant may be set straight into the ground, with the head about an inch under the surface in a straight line, about a foot asunder, or more, in the rows, and two feet distance row from row; and after having finished the whole spot of ground, you may sow a thin crop of onions, which being plants that do not root deep into the ground, nor spread much above, will do the liquorice no damage the first year; for the liquorice will not shoot very high the first season, and the hoeing of the onions will also keep the ground clear from weeds; but in doing of this you must be careful not to cut off the top shoots of the liquorice plants when they appear above ground, which would greatly injure them; and also observe to cut up all the onions which grow near the heads of the liquorice: and after your onions are pulled up, you should carefully hoe and clean the ground from weeds; and in October, when the shoots of the liquorice are decayed,* you should spread a little very rotten dung upon the surface of the ground, which will prevent the weeds from growing during the winter, and the rain will wash the virtue of the dung into the ground, which will greatly improve the plants.

In the beginning of March following you should slightly dig the ground between the rows of liquorice, burying the remaining part of the dung; but in doing of this, you should be very careful not to cut the roots. The stirring of the ground will not only preserve it clean from weeds a long time, but also greatly strengthen the plants.

The distance which I have allowed for planting these plants, will, I doubt not, by some be thought too great, but in answer to that, I would only observe, that as the large size of the roots

* Another authority says, "the tops of the liquorice are cut every year."
Editor.

is the chief advantage to the planter, so the only method to obtain this, is by giving them room; and besides, this will give a greater liberty to stir and dress the ground, which is of great service to liquorice; and if the plantation designed were to be of an extraordinary bigness, I would advise the rows to be made at least three feet distant, whereby it will be easy to stir the ground with a breast plough, which will greatly lessen the expense of labour.

These plants should remain three years from the time of planting, when they will be fit to take up for use, which should not be done until the stalks are perfectly decayed; for when it is taken up too soon, it is subject to shrink greatly, and lose in weight.

LIST OF TREES AND PLANTS, SUITABLE FOR CULTIVATION IN THE SOUTHERN UNITED STATES.

MADDER.—This was cultivated in South Carolina, previously to the American revolution to a considerable extent, owing, it is believed to the recommendation and example of the late Mr. Loocock, who wrote a pamphlet on the subject of the cultivation of the plant. Why attention was not paid to it, after the war cannot easily be ascertained. The cultivation of indigo, a crop never very profitable, and notoriously injurious to the health of the slaves, was resumed, and continued regularly until the ground ceased to produce it, or until the growth of cotton opened a new source of wealth to the desponding inland planter. After the peace of 1783, the demand for madder in the United States was steady, although not great; and all that was used for our domestic manufactures came from Holland. The price for some years before the embargo of 1807, averaged about 20 cents per lb., but in one year after the suspension of foreign intercourse between the United States and Amsterdam, it rose to one dollar per lb.; for some months past it has been steady at 50 cents; the reduction of the price been effected by the supply from the Mediterranean.

It is important to remark, that the madder of Smyrna has been

found far superior as a dye to the Dutch madder. This fact has recently been ascertained by the fair experiments of Mr. William Salisbury of the Botanic Garden of Sloane street, and Brompton near London, who states in the Transactions of the Soc. for the Encouragement of Arts, &c. vol. 25, p. 105, that he had extracts with the madder he raised, (the seeds of which had been sent from Smyrna) made in the same manner with the prepared Dutch madder of the shops, and found that the latter did not bear any comparison in point of colour with that of his own. An extract of the common madder, (rubia tinctorum) which had been some years growing in the garden at Brompton also proved inferior in colour to that raised from the Smyrna seeds. Both extracts were prepared in the same way, viz. by boiling the roots, and making a precipitate from them by alum, and vegetable alkali. Mr. Arbuthnot, (see Archives p. 283,) says too, that Turkey madder produces abundance of seed, which the common sort does not,* and that it puts out many vigorous and solid runners, whereas those of the common are hollow, and produce none of the best part of the madder.

Until the Smyrna madder shall be imported, the common madder at present in the United States may be cultivated.

During a time of scarcity of madder in England, and its consequent high price, the "London Society for the promotion of Arts, Manufactures, Commerce, and Agriculture," offered large premiums for the cultivation of the root; in consequence of which, and of the great demand for it by the manufacturers, the article was cultivated extensively. Mr. Arbuthnot† began it in the year 1765, and carried it to the extent of fifty acres, with great success and profit for some time.—Madder is a native plant of the South of Europe, the Levant, and Africa, but accommodates itself to the cold moist climate and soil of the province of Zealand, (where the Dutch madder is almost exclusively cultivated,) and to that of Great Britain. There can be no doubt

* Mr. M'Mahon, of Philadelphia, confirms the fact of the common madder producing but few seeds.

† For his paper on the subject, see the last No. of the Archives.

of the plant thriving well in every part of the United States, and few plants promise better than madder, owing to the rapid increase of our manufactures, even should there be no foreign market for the article, upon which, however, after peace, we may reasonably count. We may also expect that its quality will be increased from the climate and soil approaching so much nearer than either Zealand or England, to the native place of the plant.

It has also been found that if the madder root be employed fresh, it affords a finer colour than can be obtained from it after it has been dried, and also yields that colouring matter in greater quantity, nearly in the proportion of two to one. For home consumption, therefore, the expense and trouble of powdering the roots will be saved.*

Olives, *Capers*, *Figs*.—The following letter on the cultivation of these fruits, was addressed by Mr. Jefferson while minister of the United States at the Court of France, to the Agricultural Society of South Carolina, and published by them in 1788.

Paris, July 30, 1787.

"I was induced, in the course of my journey through the south of France, to pay very particular attention to the objects of their culture; because the resemblance of their climate to that of the southern parts of the United-States, authorizes us to presume we may adopt any of their articles of culture, which we would wish for. We should not wish for their wines, though they are good and abundant. The culture of the vine is not desirable in lands capable of producing any thing else. It is a species of gambling, and of desperate gambling too, wherein, whether you make much or nothing you are equally ruined. The middling crop alone is the saving point: and that the seasons seldom hit. Accordingly we see much wretchedness amidst this class of cultivators. Wine too is so cheap in these countries, that a labourer with us, employed in the culture of any other article, may exchange it for wine, more and better than he could raise himself.

* See head "Useful Arts" for directions to preserve and use fresh madder.

It is a resource for a country, the whole of whose good soil is otherwise employed, and which still has some barren spots, and a surplus of population to employ on them. There the vine is good, because it is something in the place of nothing. It may become a resource to us at a still earlier period, when the increase of population shall increase our productions beyond the demand for them, both at home and abroad. Instead of going on to make an useless surplus of them, we may employ our supernumerary hands on the vine. But that period is not yet arrived.*

The almond tree is also so precarious, that none can depend for subsistance on its produce, but persons of capital.

The caper, though a more tender plant, is more certain in its produce; because a mound of earth, of the size of a cucumber hill, thrown over the plant in the fall, protects it effectually against the cold of the winter. When the danger of frost is over in the spring, they uncover it, and begin its culture. There is a great deal of this in the neighbourhood of Toulon. The plants are set about eight feet apart, and yield one year with another about two pound of capers each, worth on the spot six-pence *sterling* the pound. They require little culture; and this may be performed either with the plough or hoe. The principle work is the gathering of the fruit, as it forms. Every plant must be picked every other day from the last of June till the middle of October. But this is the work of women and children. This plant does well in any kind of soil, which is dry; or even in walls, where there is no soil; and they last the life of a man. Toulon would be the proper port to apply for them. I must observe that the preceding details cannot be relied on with the fullest certainty;

* This reasoning applies very forcibly to the Atlantic States, but at the time the above excellent and patriotic letter was penned, the Western States except Kentucky, were not settled. In those states wine is now made to a profit, from European grapes, by two colonies of Swiss; and also at Harmony, near Pittsburgh by a settlement of Germans. *See Cumming's Tour.* Our native grapes would supply much better wine than what is transported from the seaports: and every industrious farmer might supply his own table with the article, at one-fourth the cost of imported wine, and yet not encroach upon the main business of the farm. *Editor.*

because in the canton, where this plant is cultivated, the inhabitants speak no written language, but a medley, which I could understand but very imperfectly.*

"The fig and the mulberry are so well known in America, that nothing need be said of them. Their culture too is by women and children, and therefore earnestly to be desired in countries, where there are slaves. In these the women and children are often employed in labours disproportioned to their sex and age. By presenting to their master objects of culture, easier and equally beneficial, all temptation to misemploy them would be removed, and the lot of this tender part of our species be much softened. By varying too the articles of culture, we multiply the chances of making something, and disarm the seasons, in a proportionable degree, of their calamitous effects.

"The olive tree is the least known in America, and yet the most worthy of being known. Of all the gifts of Heaven to man, it is next to the most precious, if it be not the most precious. Perhaps it may claim a preference even to bread; because there is such an infinitude of vegetables, which it renders a proper and comfortable nourishment. In passing the Alps at the Col de Tende, where they are mere masses of rock, wherever there happen to be a little soil, there are a number of olive trees, and a village supported by them. Take away these trees, and the same ground in corn would not support a single family. A pound of oil, which can be bought for *3d.* or *4d. sterling*, is equivalent to many pounds of flesh, by the quantity of vegetables it will prepare, and render fit and comfortable food. Without this tree the county of Provence, and territory of Genoa would not support one half, perhaps not one third, of their present inhabitants. The nature of the soil is of little consequence, if it be dry. The trees are planted from 15 to 20 feet apart, and when tolerably good will yield 15 or 20 pound of oil yearly, one with another.

* Until the true caper shall be imported, the common garden Nasturtium, *Tropeolum majus*, which by many are preferred to capers, might be cultivated. In the Philadelphia market great quantities are annually sold to excellent profit, for pickling. *Editor.*

There are trees, which yield much more. They begin to render good crops at 20 years old, and last 'till killed by cold, which happens at some time or other, even in their best positions in France: but they put out again from their roots. In Italy, I am told, they have trees 200 years old. They afford an easy, but constant employment through the year, and require so little nourishment, that, if the soil be fit for any other production, it may be cultivated among the olive-trees, without injuring them. The northern limits of this tree are the mountains of the Cevennes from about the meridian of Carcassonne to the Rhone; and from thence the Alps and Appenines as far as Genoa, I know, and how much farther I am not informed. The shelter of these mountains may be considered as equivalent to a degree and an half of latitude at least; because westward of the commencement of the Cevennes, there are no olive-trees in 43°½, or even 43°, of latitude; whereas we find them *now* on the Rhone at Pierrelatte in 44°½, and *formerly* they were at Tains, above the mouth of the Isere in 45°, sheltered by the near approach of the Cevennes and Alps, which only leave there a passage for the Rhone. Whether such a shelter exists, or not, in the states of South Carolina and Georgia, I know not. But this we may say, that either it exists, or that it is not necessary there—because we know that they produce the orange in open air; *and wherever the orange will stand at all, experience shews the olive will stand well, being a hardier tree.* Notwithstanding the great quantity of oil made in France, they have not enough for their own consumption, and therefore import from other countries. This is an article, the consumption of which will always keep pace with its production. Raise it, and it begets its own demand. Little is carried to America, because Europe has it not to spare, we therefore have not learnt the use of it: But cover the southern states with it, and every man will become a consumer of it, within whose reach it can be brought in point of price. If the memory of those persons is held in great respect in South Carolina, who introduced there the culture of rice, a plant which sows life and death with almost equal hand, what obligations would be due to him, who

should introduce the olive-tree, and set the example of its culture! Were the owners of slaves to view it only as the means of bettering their condition, how much would he better that by planting one of those trees for every slave he possessed! Having been myself an eye-witness to the blessings which this tree sheds on the poor, I never had my wishes so kindled for the introduction of any article of new culture into our own country. South Carolina and Georgia appear to me to be the states, wherein its success, in favourable positions at least, could not be doubted; and I flattered myself, it would come within the views of the society for agriculture to begin the experiments, which are to prove its practicability. Carcassonne is the place, from which the plants may be most certainly and cheaply obtained. They can be sent from thence by water to Bourdeaux, where they may be embarked on vessels bound for Charleston. There is too little intercourse between Charleston and Marseilles to propose this as the port of exportation. I offer my service to the society for the obtaining and forwarding any number of plants, which may be desired.

"Before I quit the subject of climates, and the plants adapted to them, I will add, as a matter of curiosity, and of some utility too, that my journey through the southern parts of France, and the territory of Genoa, but still more the crossing of the Alps, enabled me to form a scale of the tenderest plants, and to arrange them according to their different powers of resisting the cold. In passing the Alps at the Col de Tende, we cross three very high mountains successively. In ascending, we lose these plants one after another, as we rise, and find them again in the contrary order, as we descend on the other side; and this is repeated three times. Their order, proceeding from the tenderest to the hardiest, is as follows; caper, orange, palm, aloë, olive, pomegranate, walnut, fig, almond. But this must be understood of the plant only: for as to the fruit, the order is somewhat different. The caper, for example, is the tenderest plant; yet, being so easily protected, it is among the most certain in its fruit. The almond, the hardiest plant, loses its fruit the oftenest, on account of its

forwardness. The palm, hardier than the caper and orange, never produces perfect fruit here.

I have the honour to be, &c.

TH. JEFFERSON.

The foregoing observations were addressed to the Agricultural Society of South Carolina, at a time when rice and indigo, and which gave but poor returns, were the only great export staples of the country; for cotton was then but partially raised for coarse domestic manufactures. But although the necessity of new articles of culture was severely felt, and the letter of Mr. Jefferson was addressed to a society composed of some of the most enlightened men in the union, several of whom had travelled in the olive countries, and well knew the immense consumption of the article in the world, and even saw that their own climate agreed well with the tree,* yet neither the advice to commence the planting of them, nor the patriotic offer of Mr. J. to have the plants exported, were attended to. Had the cultivation of this invaluable tree been commenced shortly after the time above mentioned, they would now have been in full bearing, and might help to supply the place of cotton.† It is *not too late even now* to begin, for it requires but little foresight to predict, that after the cessation of the present war, the profit of cotton will be but small, owing to the increased growth of it in Louisiana, the Brazils, and the British settlements in Africa; and to the heavy duties which in France, and in all the countries subject thereto, have been laid on the article.

Almonds.—Almonds have ripened even as far north as Germantown, within seven miles of Philadelphia; and the following extract from a newspaper printed at Augusta in Georgia, August 1811, will show how great is the produce in that climate.

" On the plantation of Mr. Asaph Waterman, about ten miles from this place, there are several flourishing almond trees, which were planted by the late captain Kennedy. On the 27th July,

* There are several olive trees in Charleston, which bear well.

† Mr. Jefferson has since repeatedly urged the planting of the olive tree in South Carolina and Georgia, to gentlemen from those states.

were gathered from these trees 53 pounds of almonds, which at 25 cents per lb. would nett more than $4. to each tree. In 1810, the same trees produced about the same quantity. In 1809, the frost killed the fruit. The trees are seven or eight years old, appear thrifty, and not subject to decay, like peach trees."

As an article of export, 25 cents per lb. is too high; but the delicious nature of the fruit would for a long time cause a great part of the produce to be consumed near the place of its growth, and would doubtless pay well. Cotton or corn might even be planted in the same field with almond trees, which although a precarious fruit, as stated by Mr. Jefferson, yet might certainly be considered as worthy of attention, if even the fruit ripened once in two years. Cotton we know is sometimes cut off by frost, and has powerful enemies in rains, caterpillars, and the lady-cow bug, and yet the planters are not deterred from continuing its cultivation.

Figs.—Figs grow in the most luxuriant manner in South Carolina and Georgia, and might be multiplied to any extent. The kind at present cultivated, however, do not dry well, and turn sour after heavy rains, or heavy dews. There are many varieties of figs in Europe, which might be imported in order to find out that which would best suit the climate.

A Portuguese gentleman, Mr. Corea de Serra, informs the editor, that the WHITE FIG of Portugal and of the south of Spain, is the most juicy, and is esteemed the best for drying. Cuttings, properly put up, might be easily imported. A sandy dry soil, and a situation remote from moisture and fogs, are indispensably necessary for the successful cultivation of figs.

Rhubarb.—Several species of rhubarb have been accurately described. 1. The *Rheum Rhaponticum*, Rhapontic Rhubarb or Turkey Rhubarb. 2. *R. Undulatum*, Waved-leaved Rhubarb. 3. *R. Palmatum*, officinal or Russia Rhubarb. 4. *R. Compactum*, Thick-leaved Rhubarb. 5. *R. Ribes*, Warted-leaved Rhubarb. 6. *R. Tartaricum*, Tartarian Rhubarb. 7. *R. Hybridum*, Bastard Rhubarb.

1. The *Rheum Rhaponticum* is the species known in commerce

by the name of Turkey Rhubarb; and is cultivated by many persons in England, as well on account of the medicinal qualities of the roots, as the utility of the foot stalks of the leaves for tarts.* It has also been cultivated with great success by Mr. John Lang of Philadelphia, from seeds sent to him several times from the Botanic garden, Edinburgh. Other persons in the vicinity of Philadelphia, and in New Jersey, who procured plants from Mr. Lang, have cultivated it with equal success. In the dry light soil of Haddonfield, (New Jersey,) it thrives with uncommon luxuriance.

"It has a large thick root, which divides into many strong fleshy fangs, running deep in the ground: the outside is of a reddish brown colour, and the inside yellow, from which arise several leaves in number, according to the size of the root: they are smooth, of a roundish heart-shape, having very thick foot-stalks, of a reddish colour, which are a little channelled on their lower parts, but flat at their top. From between the leaves arises the flower stem, which is of a purple colour, garnished with one leaf at each joint. The stalks grow from two to three feet high, and are terminated by thick, close, obtuse spikes of white flowers, and are succeeded by large triangular brown seeds, having a border or wing at each angle."†

It may be propagated by seeds sown in the spring in beds, and transplanted in squares four feet each way. A *deep*, *loose*, *rich soil* is essentially requisite to a profitable culture. The head throws out also a number of offsets or young buds, by dividing which the plants may be greatly multiplied. In three years more, these new roots may be treated in like manner.

Mr. Lang has been in the practice, after taking up his rhubarb roots in the autumn for drying, and dividing the buds; to lay them on the ground in a moist situation, covering them well with leaves or tanner's waste bark; and in the spring he finds them fresh and ready for planting the moment the weather will permit.

* For this purpose the stalks and midribs are skinned, cut very small, and stewed with sugar. No water must be used.

† Martyn's edition of Millar's Gardener's Dictionary.

He also has found that the greater part of the plants do not produce seeds, and it often happens that the flowers on one side of the plant will perfect their seed, while those on the other never ripen. After the plant goes to seed, the principal root decays, and should therefore be taken up and dried, and the buds separated from the crown to form new plants.

When the roots are dug, they are to be well washed, the fibres taken away, and not the smallest particle of bark left on the roots: then cut into small pieces, and strung to dry on a pack-thread in the form of festoons so as not to entangle, in the warm air of a kitchen or store room,* till the superfluous moisture is exhaled, to prevent their becoming mouldy or musty. The parings will make excellent tinctures in spirit.

The *Rheum Palmatum* is a native of the mountains of Tartary, according to Bell, and is brought by the annual caravan to Petersburgh and Moscow. It also braves the cold of Russia, and thrives well in Scotland and England, into which countries the seeds were introduced by the late Dr. Mounsey from Russia, about the year 1762.† The cultivation of it has been attempted in the environs of Philadelphia, by Mr. Lang, from seeds imported from England, but without success. "The seeds," he says, "vegetate, and the young plants appear for some time healthy and vigorous, but whether owing to the great heat of the sun, the dryness of our summers, or the poverty of the soil, or to all those causes combined, it has so happened, that nine-tenths of the plants generally die before the end of summer."

Opium.—All Europe, and North and South America might be supplied with this important drug by the southern states. The opium poppy, which is the "white poppy," (papaver album),

* In the southern states a drying-house, open on all sides, would answer unless in a very rainy season.

† For an account of the experiments of those who cultivated rhubarb in England and Scotland, the reader is referred to the "Transactions of the Society Arts, London," for 1784, 1793,—4—5—6—7—8. Dr. Martyn, in his inestimable edition of Millar's Gardener's Dictionary, has arranged and condensed all the information extant on the subject.

grows well in every part of the United States, from New Hampshire to Georgia,* but it is in the three most southern states and in Louisiana, that the cultivation of the plant would be most likely to produce the greatest profit, in consequence of the number of children, and of old negro men and women, who might collect the opium, although not capable of paying for their support in any other way. From the experiments by various persons in making opium in the United States and England, all doubts as to the quality of the article being fully equal to that produced in India or the Levant, are dispelled.

The calamities of war, of which there does not seem to be any probability of a speedy cessation, will multiply the demand for this article an hundred fold; and as the poppy is an annual plant, it will of course be one of the first of those mentioned in this paper, to yield a return. The cultivation of the poppy even for the oil, which the seeds yield, would be extremely profitable, as it would supply the place of whale oil for lamps, and answer for numerous other purposes in domestic concerns, the arts, and in pharmacy.† The cake too, after the pressure of the oil, will be found, like the cake of flaxseed and the *sesamum* (or Benne) seeds, excellent food when used in moderation for fattening cattle; an object certainly of no small importance in most parts of the three southern states.

To the foregoing may be added, anniseed, senna of Alexandria, Jalap, and Ipecacuanha from the Brazils, Ginger, and Madeira nuts, absurdly called English walnuts; all these would prove highly worthy of attention. In order to procure the seeds and roots, it will be only necessary to make it an object for the enterprising traders of the northern and middle states to bring them

* See Archives, vol. 2, p. 279.

† In Archives, vol. 2, p. 177, a promise was made to give an abstract of the publications of Dr. Cogan, and Mr. Van Eys of Amsterdam, on the oil of poppy: but on reflection this has not appeared necessary, as the Editor is informed the oil has by no means a pleasant taste, although quite innoxious: and as no want of oil for the table need exist, considering that the Benne or *sesamum* plant grows luxuriantly in the southern states.

over; and all of them may be introduced without difficulty, and speedily.

Finally, the numerous vegetables possessing valuable dyeing properties, and with which the southern states abound, might be profitably cultivated, and would be acceptable presents to the manufacturers of the northern states. To particularize them would be unnecessary, as they are enumerated in Dr. Ramsay's History of South Carolina.

ON THE CULTIVATION OF THE FULLER'S TEAZLE—DIPSACUS FULLONUM.

IT is propagated by sowing the seeds in March, upon a soil that has been well ploughed: about one peck of seed will sow an acre. When the plants are up, they must be hoed, and then singled out to about six or eight inches distance; and as they advance, and the weeds begin to grow again, they must be again hoed, cutting out the plants so as to let them stand a foot asunder. The first appearance of teazle is much like that of lettuce. The second year the plants will shoot up stalks with heads, which will be fit to cut in august (in England) and when ripe they turn brown. The stalk is a foot long. When cut, they are to be tied in bunches of 25, setting them in the sun: but if the weather be not fair, they must be set in rooms to dry. The common produce is about one hundred and sixty bundles or staves upon an acre. Old pasture lands, the soil of which is a strong clayey loam, is best adapted to the culture of teazle.

The above directions are collected from the edition of Miller's Gardener's Dictionary, by professor Martyn of Cambridge.

The Editor was informed by a person acquainted with the cultivation of teazle, that the heads should be pulled before they are quite ripe, and the top branch pinched off to force out lateral burrs. The practice of topping the cotton plants once or twice to increase the blossoms, would lead to a supposition, that the same practice might be advantageously adapted with the teazle.

CALCULATION OF THE GROUND GONE OVER IN PLOUGHING AN ACRE OF LAND.

From Dickson's Agricultural Magazine. London, 1808.

AN acre of land (vide *Hutton's Arithmetic*, page 18) contains four thousand, eight hundred, and forty square yards; which being cut into four parts, namely, by slices of nine inches each, would give nineteen thousand, three hundred, and sixty yards. Now, there being one thousand, seven hundred, and sixty yards in a mile, (*Hutton*, page 17); if we use the latter number as the divisor, and the former as the dividend, the quotient will, *I believe*, amount to exactly eleven miles, thus:

4840 square yards in an acre.
Multiply by 4 slices in the breadth of each yard.

1760)19360(11 miles.
1760

1760
1760

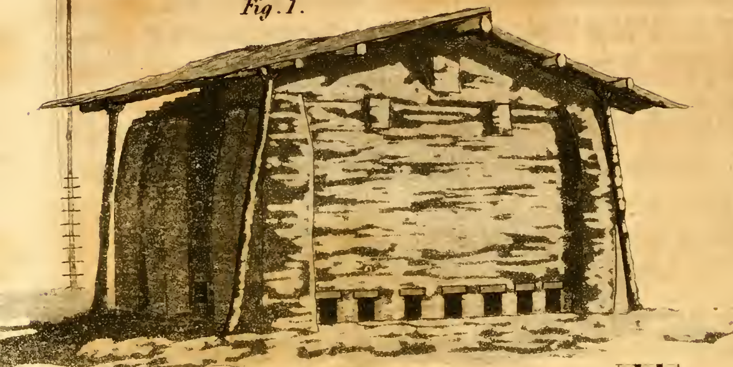
Here we have no less than eleven miles, without considering the turns at the headlands; if we add them the following augmentation of measure will arise from the most moderate calculation.

Let us take the average *stretch*, or length of furrow, at two hundred yards, which in nineteen thousand, three hundred, and sixty yards, will give nearly ninety-seven furrows in every acre. Now, the half breadth of each ridge, being taken at two yards, and allowing the plough to shoot two more beyond where it works, and as much to go back again, say six yards in all, at each headland, that multiplied by ninety-seven, will give five hundred and eighty-two, or about the third of a mile, merely for the ground which the *plough itself* goes over.

If we consider the great sweeps which long teams, and bad drivers, make at the ends of the land, we should begin upon an endless computation! I have supposed twelve feet ridges, and taken half that breadth as the overlap at every *bout*.

Fig. 4.

Fig. 1.



External Elevation

Position of Bricks in the Kiln above the arches

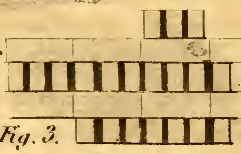
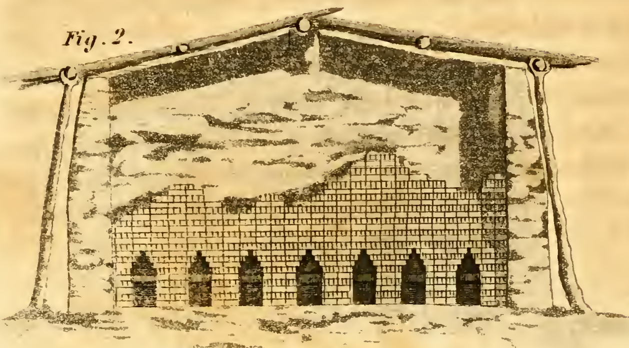


Fig. 3.

Fig. 2.



Transverse Section

PAPERS ON THE USEFUL ARTS.

METHOD OF MAKING BRICKS AS FOLLOWED IN PHILADELPHIA.

With a plate of a brick kiln.

THE clay is invariably dug in the autumn, and during the winter. It is dug in spits, each spit being one foot deep, four feet wide, and 16 feet long, which makes a mass for one thousand bricks, and is thrown aside into a loose heap, until the weather will allow it to be worked in the spring. It is then cut, slashed, and worked with a spade into heaps of about six feet by ten feet in compass, a mass sufficient to make 2,000 brick; water is then thrown upon it, (the quantity of which is different in different clays), and permitted to remain for twenty-four hours, when it is tempered, and skirted all round, patted together, and sprinkled lightly with water, smoothed neatly over with a spade, keeping the mass tight and compact, and finally covered with boards, cloths, or bushes, to prevent the injurious effects of the sun and air. It is then ready for the moulder. At day dawn, the wheeler, with his barrow running on a platform or barrow way, comes to the prepared mass, and loading his barrow, carries it to the table of the moulder, putting it on with a spade tight and compact: the moulder then takes the brick mould with his left hand, and a handful of dust in his right, from a tub placed at his left side, and sprinkles or rubs it over the table; he then cuts down with his two hands finger end to finger end, enough of the clay to make a brick and a half; this is called a *walk;* then forming the mass into a shape somewhat of the mould, by first drawing it towards him, then pushing it from him, and again drawing it towards him, he forces the clay into the mould, so as to fill the corners, and strikes off the superfluous clay with an instrument called a plane; which is a steel plate about one-eighth or one-tenth of an inch thick, 8 inches long, 5 wide, with a handle near the end. When the mould is filled, the bearer takes it away and delivers the clay therefrom in regular order on the floor, making 44 rows, each 53 bricks along. He then returns to the table

for another, and in coming back, he scrapes out one end and a side of the mould: the next time he reverses the mould, and cleans the other end and other side: the scraper is made of hickory,* and is attached to his right side by a string, but not hanging lower than the knee, otherwise it will drag on the next row when he stoops to lay down the bricks.† Immediately after the rows are finished, the bricks are turned upon their edges, and if a welt is found upon the under side, it is removed by rubbing the *flat* of the hand over it. For very nice brick a knife is used to remove the welt. After ten or fifteen minutes they are removed to a board shed 21 feet long, where they are *hacked*, that is piled up on edge, so that one brick is made to stand with a small angle on two others: the further end standing on two, and the nearer end on one. This part of the business is divided among the gang, each one turning and hacking 500 brick, and taking care to leave the breadth of the middle finger between each brick. The courses amount to 16 or 20, but for beginners 17 will be enough. The courses are reversed, to favour the free passage of the air through them. It is highly requisite that the bricks forming the first ten courses should be well dried, otherwise they will be crushed by the weight of those above them. The bricks remain in the shed until the kiln is ready, and care is taken to keep out all moisture. When ready, the bricks are carried by one or two gangs, to the kiln; the boys loading the barrows, the wheeler and temperer wheeling all and tossing them to the moulder, who sets them in the kiln. The setting of the bricks is an important part of the business, which cannot be perfectly understood without an actual inspection of the work. The following is an outline of the process.

The object is so to place the bricks as to permit the free passage of the fire through them; and for this purpose the moulder beginning at the back of the kiln, runs up seven straight courses forming a part of the facing of the arch, setting the bricks on edge. To insure the accurate arrangement of these courses, a straight

* See plate 2d figure 4.

† The cleaning only half the mould at a time, is found to favour the delivery of the brick from it.

edged board called a ruler about four inches wide, is run in from the external holes, and reaches across the kiln : this board is placed an inch and a half back from the sides of the kiln holes, and against the edge of this board the bottom course is set.* The bricks in the third and seventh courses are set tight, or close ; but those in the other courses are set a finger breadth from one another. This vacancy is essential.

The setter then begins to overspan, that is to form the arch, by placing the bricks so, that every course of bricks may extend one inch and a half,† beyond the course immediately below it, for five coures in height, taking care to *skintle* well behind, that is to back up or fill up with brick against the overspanners.

The next seven courses on the opposite side of the arch being then set as before ; the setter again begins to overspan five courses to meet the overspanning on the opposite sides, thus forming the arch. This is called the rounding, and is a nice and important operation. The two first courses may be set with safety, but of the last three which close the arch, ten bricks only must be set at a time, *one on two* to meet the top courses of the overspannings : if more are set, the overspanners not being supported on the back will cause the arch to fall in. The middle brick is then run up as soon as possible as high as the rounding, viz. 14 courses, the setter taking care to have the heads of the middle brick tight against the ends of the roundings. When the setter has so far proceeded, he sets four bricks end against end, (technically four nine inches) and then proceeds to set the kiln to the intended height, by the rule of three bricks upon three (see plate 2d. fig. 3.) reversing each course, keeping the heads of the bricks tight against each other. Care must be taken, not to set his intended height without the middle brick being up against the

* When the bottom course is set, the board is commonly removed, but it is better to leave it in, to prevent the rising of the dust, which will settle on the lower courses of bricks and cause them to burn unequally.

† Should the inch and a half in overspanning this rounding not meet the top course of the facing, more space may be taken.

rounding. Thus the setter proceeds until the kiln is full; observing to make each hole alike.

The top course is covered with bricks placed flat and so disposed that one brick covers part of three others. This process is called platting.

The kiln being full of bricks, wood is put in the kiln holes, and set on fire in order to dry the bricks gradually and equally. The wood is put on an iron bar placed across the kiln holes and raised about three inches from the ground, to increase the current of air. In about three days and three nights, the top of the kiln must be examined, in order to see whether the *fire is up*, that is, whether it has reached the top of the kiln; if so, the smoke (called water smoke,) will change from a light to a black hue: the roof is then taken off, the fire is pushed, and a strong regular red heat attentively kept up for from 48 to 60 hours more; care must be taken not to choak the holes, or the draught will be prevented, the bottom course will be partially burnt, and the fire will not work through. The heat must not be so strong as to be white, for the bricks will then melt or drop. At the end of the time just mentioned, the kiln will be found to have sunk about 9 inches: but the shrinkage depends on the nature of the clay,* and after one or two burnings the sinking of the kiln will pretty accurately determine when the bricks are sufficiently burnt. Satisfaction having been obtained on this point, all the holes must be closed up with brick, and daubed over with wet sandy loam, so as carefully to exclude the air, for four or five days; at the end of which the *pistoing* is to be opened, the *platting* piled on the walls, and the bricks regularly taken down. From 50 to 60 cords of wood are consumed at the burning of 140,000 brick. Split wood is used inside of the kiln, but that under the wall may be round.

There are seven kiln holes in each end; all two feet high, and 16 inches wide, with fire-stone heads outside. The inner stone of the kiln hole, is laid one foot higher than the outside stone, in or-

* The stronger the clay, the more it shrinks. In general, 35 courses will shrink 9 inches.

der to give the kiln a draught, and not to confine the wood under the wall. The distance between each kiln hole is the length of three bricks and two inches. The height of the kiln is commonly 13 feet, giving room for 35 or 36 courses.* The average width in the clear is 28 feet, and each kiln contains about 140,000 bricks. The bottom of the kiln must be level. In Philadelphia, they are paved with brick having the flat side down. The mouth of the kiln, (called the pistoing) is ten feet wide: see A. plate 2 fig. 2d—when the kiln is full, this is closed with a wall commonly of nine inches of brick, set on edge, the whole height of the work, and daubed with a sandy loam mixed with water, as tight as possible: but it is better to build the wall three bricks and a half thick from top to bottom, in order to diminish the risque of its cracking, and to retain the heat. In walls of such a thickness, two stout props should be placed at each corner of the kiln, at the distance of a brick and a half from the corner of the side walls. The side props ought not be so thick; but they must not bend, when the pressure arising from the expansion of the kiln forces them out. The external cover of the kiln consists of boards, and is supported by props.

ON PRESERVING MADDER ROOTS, AND ON DYEING WITH FRESH ROOTS.

From D'Ambourney's Experiments on Dyeing.

THE planter may preserve, in cases of necessity, his crop for a whole year in a trench, observing only to lay an alternate bed of roots and a little earth. In this manner he may wait for a proper opportunity of selling them. When about to be used, they must be washed clean of the earth adhering to them, and for every pound of dried madder used, there must be four of the green root.† The roots are to be choped moderately small, and

* In a first experiment there ought not to be so many courses.

† This difference appears very great: the dyer will of course make cautious experiments on the relative proportions between dried and fresh madder.
Editor.

afterwards bruised in stone or wooden mortars, *(by no means in iron,)* till they are reduced to a sort of pulp. This pulp must be put into the boiler, when the water, to which no addition must be afterwards made, is somewhat more than lukewarm. It is then left till it be so hot as scarcely to bear the hand in it. The stuff or cotton is then to be plunged in, and kept moving for three quarters of an hour, the bath being simmering all the time. Lastly it is made to boil for three quarter of an hour.

NICHOLS'S PATENT PRESS.

THIS powerful combination and application of the lever, was made by Israel Nichols of the county of Otsego, New York, and was originally designed for the use of clothiers, and for pressing cyder. The following certificate proves its powers.

State of New-York, Otsego county, ss.

By the request of Israel Nichols, of the town of Burlington, in said county, we whose names are hereunto annexed, met at the Clothier's Works of *Martin Lee*, and *Abner Fitch*, in Burlington, on the 13th day of January, 1812, and saw the operation of one of the above named I. Nichols's Patent Clothier's Presses, which operated with two rollers and two levers; (the length of the first is five feet) which performed in the following manner: two blocks, were prepared of good white oak, between which were layed twenty-three dollars, one on top of the other, which were forced into the solid blocks, till the blocks met together, with the strength of one man, with one hand; and by adding a rope to the first lever, which went round the second roller, to which roller was added the second lever, of five feet nine inches, on the end of which was hung two pounds and eleven ounces weight, it pressed still harder, till the weight came to the floor; and we saw the press beam when down in full force raised up to its full height and brought down again to its full force, to perform as above mentioned, in less than one minute, by one man only. Signed by Martin Lee, Abner Fitch, and eleven others.

END OF VOL. III.

INDEX.

PLATES.

CUTS.

ERRATA IN VOL. III.

Page 175, line 18, for "*case,*" read cave.
203, line 14, in some copies, for "*limbers,*" read timbers.
——, line 7 from bottom, in some copies, for "*timbers,*" read limbers.
272, dele "*Mr.*"
305, note, for "*Mag.*" read Jonrnal.
401, line 1, for "*ovem.*" read over.